НА ПУТИ
В НАУЧНУЮ БИБЛИОТЕКУ

Saratov State University

ON THE WAY TO SCIENCE LIBRARY

Course book for students
of natural sciences

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НА ПУТИ В НАУЧНУЮ БИБЛИОТЕКУ

Учебное пособие для студентов
естественнонаучных специальностей университета

ИЗДАТЕЛЬСТВО САРАТОВСКОГО УНИВЕРСИТЕТА
2009

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Цель учебного пособия – развитие у студентов естественнонаучных специальностей умений читать специализированную литературу на английском языке. Пособие содержит задания на формирование у студентов разных видов чтения литературы по специальности на английском языке и расширение их лексического запаса за счет усвоения терминов и общенаучной лексики.

Учебное пособие предназначено для обучения студентов естественнонаучных факультетов университетов. Материалы пособия могут быть использованы в учебном процессе в профильных классах школ, лицеев и гимназий.

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ПРЕДИСЛОВИЕ

Учебное пособие «On the Way to Science Library» предназначено для развития у студентов естественнонаучных специальностей умений читать специализированную литературу на английском языке. Цель учебного пособия – формирование у студентов разных видов чтения литературы по специальности на английском языке и расширение их лексического запаса за счет усвоения терминов и общенаучной лексики. Пособие состоит из восьми модулей, каждый из которых может использоваться для подготовки специалистов по английскому языку в рамках одного из естественнонаучных направлений: биология, геология, математика, информационные технологии, нано- и биомедицинские технологии, химия, физика и нелинейные процессы. Модули состоят из семи разделов, в свою очередь тексты, предложенные в каждом из них, сгруппированы вокруг определенной темы.

Необходимо отметить, что в условиях приоритета междисциплинарных подходов к решению научных задач данное пособие приобретает особую актуальность, так как может использоваться для освоения студентами языка смежной специальности. Умение читать литературу по смежной специальности позволяет существенно расширить диапазон используемой оригинальной литературы для решения производственных и научно-исследовательских задач.

Особенностью данного учебного пособия является то, что оно позволяет организовать эффективную самостоятельную работу студентов. Повторяемость структуры и логики заданий каждого модуля и каждого раздела позволяют студентам в самые короткие сроки освоить порядок работы с учебным материалом.

Необходимо отметить специфику структуры предлагаемого пособия. Каждый раздел состоит из трех частей. Задания первой части составлены таким образом, что в результате последовательного их выполнения студенты получат цельный текст. Задания второй и третьей части раздела совпадают и поэтому их можно использовать для групповой и парной работы. Каждая часть заканчивается упражнением, цель которого закрепление лексических навыков.

При разработке учебного пособия использовались подходы, которые соответствуют подходам к обучению/изучению иностранных языков изложенным в монографии «Общеевропейские компетенции владения иностранным языком: изучение, обучение, оценка».

Решение задач, поставленных авторами данного пособия, приобретают особую значимость и актуальность в условиях реформирования высшей школы и перехода на двухуровневую систему образования. Использование данного пособия в учебном процессе будет способствовать повышению академической мобильности студентов (одного из обязательных параметров Болонского процесса), так как помогает подготовить студентов к участию в учебном процессе на английском языке.

Учебное пособие может быть использовано для обучения студентов-бакалавров естественнонаучных факультетов университетов, для тех, кто при поступлении в магистратуру сменил специальность и им предстоит освоить язык новой специальности, чтобы эффективно использовать англоязычную специализированную литературу. Авторы полагают, что материалы пособия могут быть использованы в учебном процессе в профильных классах школ, лицеев и гимназий.

Разработка пособия осуществлялась в рамках инновационной образовательной программы Саратовского государственного университета.

1. READING ROOM FOR STUDENTS OF BIOLOGY

Unit 1. Cells

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. Hooke had sliced thin sections of cork to view under a microscope of his own design.
b. Cells were first described by the English scientist Robert Hooke, who in 1665 published a book about his findings.
c. The first description of living cells was provided in 1674 by Dutch scientist Anthony van Leeuwenhoek, who observed bacteria and protozoa under his microscope.
d. Hooke called the minute structures he was able to see cells because he thought the boxes looked like monastery cells.
e. Ten years later Leeuwenhoek gave the first accurate description of red blood cells.

Exercise 2. Fill in the gaps with the words from the box. Read the whole paragraph.

to	use	first	at	with	about	however	of	can	just

Scientists (1)… a variety of microscopes to study cells. In the light microscope, the background is brightly lit, the objects studied are dark, and the power of magnification is (2)… 1,000. In some microscopes, (3)…, the background is dark, and the objects examined are bright. Electron microscopes, which were (4)… developed in the early 20th century, use magnetic fields and waves (5)… electrons to get an image. Electron microscopes (6)… magnify images up to one million times, allowing biologists (7)… examine the structure and contents of cells (8)… an extremely fine scale.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. by the 19th century/more/Improvements/allowed/in microscopes/detailed investigations/.
2. two German scientists, Matthias J. Schleiden and Theodor Schwann/independently/that/In the 1830s/called the cell theory/ Scottish botanist Robert Brown/concluded/the cell nucleus/that/discovered/and/the basis of all life/were/cells/a view/called/.
3. in 1858/that/Rudolf Virchow/from/another German scientist/all cells/previously/existing cells/develop/stated/.
4. to preserve cells/opened/for intensive research/During the late 19th century/techniques/the way/ of fixing and staining tissues/.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. minute	to form an opinion : decide by reasoning
2. observe	b. very small
3. accurate	c. a dye or mixture of dyes used in microscopy to make very small and transparent structures visible, to color tissue elements so that they can be told apart, and to produce specific chemical reactions
4. description	d. to make a scientific observation
5. improvement	e. agreeing exactly with truth or a standard
6. investigation	f. the act of magnifying
7. conclude	g. an account of something
8. independently	h. the setting within which something takes place
9. stain	i. increased value or excellence
10. magnification	j. a series divided into classes
11. background	
12. scale	

*(adopted from **«cell.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Part 2
Cell Membrane

Cells can survive only in a liquid medium that brings in food and carries away waste. For unicellular (single-celled) organisms, such as bacteria, algae, and protists, this fluid is an external body of water, such as a lake or stream.

For multicellular (many-celled) organisms, the medium is part of the organism. In plants, for example, it is the sap; in animals, the blood.

The cell membrane is semipermeable—that is, some substances can pass through it but others cannot. This characteristic enables the cell to admit and reject substances from the surrounding fluid and enables the cell to excrete waste products into its environment.

The cell membrane is composed of two thin layers of phospholipid molecules studded with large proteins. Phospholipids are chemicals similar to stored fat that give the membrane its fluid quality. Some of the membrane proteins are structural; others form pores that function as gateways to allow or prevent the transport of substances across the membrane.

Substances pass through the cell membrane in several ways. Small uncharged molecules, such as water, pass freely down their concentration gradient (from the side of the membrane where they are in higher concentration to the side of lower concentration). This movement is called diffusion. Other materials, such as ions (charged molecules), must be transported through channels—membrane pores that are regulated by chemical signals from the cell. This facilitated transport requires energy for substances moving against a concentration gradient.

*(adopted from **«cell.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

requires energy chemical substances pass through the cell membrane to admit and reject substances facilitate locomotion

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Robert Hook was the first to describe the structures called cells.
2. More detailed investigations were allowed due to new discoveries.
3. Scientists from different countries concluded independently that cells were the basis of all living things.
4. Biologists are not able to examine the structure and contents of cells at an extremely fine scale.
5. The power of microscope magnification does not matter.
6. The boxes look like monastery cells.
7. Blood cells were first observed by Robert Brown.

Exercise 4. Answer the following questions:

1. What medium do cells need to survive?
2. What is the difference between unicellular and multicellular organisms?

3. Why is the cell membrane semipermeable?
4. What is it composed of?
5. How are ions transported?
6. What is diffusion?
7. How are membrane pores regulated?

Exercise 5. Match the words with their definitions.

1. liquid	a. to cause the rejection
2. medium	b. physical material from which something is made
3. waste	c. to form the substance of
4. sap	d. material (as carbon dioxide in the lungs or urine in the kidneys) produced in and of no further use to the living body
5. blood	e. the thing by which or through which something is done
6. admit	f. a quantity of electricity
7. reject	g. the fluid part of a plant
8. layer	h. to have a need for
9. compose	i. the red fluid that circulates in the heart, arteries, capillaries, and veins of a vertebrate animal and that brings nourishment and oxygen to and carries away waste products from all parts of the body
10. charge	j. neither solid nor gaseous
11. require	
12. substance	

Part 3
Cell Wall and Cytoplasm

Almost all prokaryotes, as well as the cells of plants, fungi, and some algae, have a cell wall—a rigid structure that surrounds the cell membrane. Most cell walls are composed of polysaccharides—long chains of sugar molecules linked by strong bonds. The cell wall helps maintain the cell's shape and, in larger organisms such as plants, enables it to grow upright. The cell wall also protects the cell against bursting under certain osmotic conditions.

Plant cell walls, as well as those of green algae and some other protists, are made mostly of the polysaccharide cellulose. In some plants, the cellulose is mixed with varying amounts of other polysaccharides, such as lignin, an important component of tree bark and wood. In some fungi the cell wall is composed of chitin, a polysaccharide that also forms the exoskeleton of many invertebrates such as insects and crabs. The bacterial cell wall is composed

mostly of peptidoglycan, which is made up of polysaccharides and amino acids. Diatom cell walls have a high concentration of silica, which gives them a glass-like appearance.

Water is the largest component of cytoplasm. Depending on the cell and its needs and conditions, water concentration varies from about 65 percent to roughly 95 percent. Suspended in the cytoplasm are various solids such as proteins, carbohydrates, fat droplets, and pigments. As such, cytoplasm is a colloid rather than simply a solid or a liquid.

Changes in the concentration of solids produce an apparent streaming of the cytoplasm from place to place within the cell. When viewed through a microscope, membranes and fibrous structures are more readily visible in the cytoplasm when the concentration of solids increases. This visibility decreases as the solid content decreases.

*(adopted from **«cell.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text. What do they refer to?

visibility	protected by membrane	concentration of solids
the largest component of cytoplasm		membranes and fibrous structures

Exercise 2. Look through the text and copy out numerals and words of Latin origin. What do they refer to?

Exercise 3. Are the following statements true or false?
1. Almost all prokaryotes a rigid structure that surrounds the cell membrane.
2. The cell wall helps plants grow upright.
3. The structure of all cell walls is the same.
4. Water concentration does not depend on the cell and its needs and conditions.
5. Cytoplasm is simply a solid or a liquid.
6. The concentration of solids causes an apparent streaming of the cytoplasm.
7. Membranes and fibrous structures are visible in the cytoplasm.

Exercise 4. Answer the following questions:
1. What is a cell wall composition?
2. What is the role of cell walls?
3. What is an important component of wood?
4. What gives the bacterial cell wall a glasslike appearance?
5. What is the percentage of water in cytoplasm?
6. Which solids are suspended in it?
7. What do changes in the concentration of solids produce?

Exercise 5. Match the words with their definitions.

1. rigid	a. not hollow
2. surround	b. likely to do something
3. amount	c. to look at carefully
4. glass	d. a hard brittle usually transparent substance commonly formed by melting a mixture of sand and chemicals and cooling to hardness
5. bark	e. the total number or quantity
6. change	f. an amount that is contained or can be contained
7. solid	g. to enclose on all sides
8. stream	h. something added (as by growth)
9. view	i. the tough covering of a woody root or stem
10. readily	j. not flexible
11. increase	
12. content	

Unit 2. Biodiversity

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. Eyes are bright objects at which an enemy might strike.
b. In the tropics many fish are as brilliantly colored as jewels.
c. Nearly all fish are protectively colored to resemble their surroundings and deceive enemies or prey.
d. Some fish have eyelike spots in the tail region so that when a predator strikes what it thinks is the head, the fish can rapidly escape.
e. Yet they are protected by such tricks of camouflage as vertical black or white stripes that break up the outlines of the body and make it hard to see.

Exercise 2. Fill in the gaps with the words from the box. Read the whole paragraph.

their it fish color cause cells place lead its the

Some (1)… change color and pattern with the background on which they are lying. Groupers and flatfish are particularly effective in matching (2)… surroundings. (3)… change in these fish is controlled through their eyes. If the fish is blinded (4)… loses the power to change. Color change also takes (5)… if a fish is frightened or angry. Violent emotions react on the pituitary gland and (6)… it to pour hormones into the bloodstream. The hormones in turn affect the color (7)….

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. are caused/Color and pattern/of color cells/ in a fish/ by the grouping.
2. and/are located/that /reflect light/between the scales/on the skin/These cells/ and/particles.
3. is shaped/a many-armed star/contains/of a single color/Each cell/and/each/ pigment/like.
4. by retracting/almost invisible/in varying degrees/The pigment/exposing its color/into the arms/can become/into the center of the star/or it can expand out.
5. in other cells/of the fish/The amount of pigment/exposed to view/determines/ combined with the pigment/the color pattern.
6. the color cells/Secretion/to develop/from the pituitary gland/pigment/causes/ and.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. resemble	a. something that nourishes
2. deceive	b. possessing intelligence
3. trick	c. any of numerous marine mammals that live mostly in cold regions, feed especially on fish, mate and give birth to young on land, and use short webbed flippers to swim and dive
4. stripe	d. to be like or similar to
5. feature	e. to keep in an existing state
6. develop	f. a condition of being hot
7. nourishment	g. to cause to believe what is untrue
8. possible	h. an action meant to deceive or cheat
9. seal	i. a part or detail that stands out
10. intelligent	j. a line or long narrow section differing in color or appearance from the background
11. maintain	
12. heat	

(adopted from «fish.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Mammals

The term mammal explains one important way in which creatures in this class are set apart from other animals. It comes from the Latin mamma, which means «breast.» Every female mammal has special glands, mammae that secrete milk. The females of all but the most primitive mammalian species are viviparous. This means they bear their young alive. The young are then fed with milk until they have grown enough to get food for themselves.

Hair is a typical mammalian feature. Another basic trait of mammals is their highly developed brains—the most complex known. Particularly well developed is their cerebrum, the part of the brain that controls memory and learning. The mammalian brain enables the young to learn from the experience of their elders. Since the young mammal is dependent on its mother for nourishment, a period of learning is possible. This in turn has brought about a degree of behavioral adaptability unknown in any other group of organisms. Whales, seals, and dogs are among the most intelligent mammals, but monkeys, apes, and humans are the most intelligent of all.

The term warm-blooded does not mean that a mammal's body temperature is consistently warmer than that of the environment. In the hot tropics, in fact, the opposite is true. Warm-blooded animals, or endotherms, have an inner climate-control system that is physiologically maintained. Mammals can sustain a constant body temperature that is ideal for their bodily functions under most weather conditions.

A high metabolic rate requires a great deal of fuel in the form of food and oxygen. Their respiratory, circulatory, and digestive systems also need to be highly efficient to transform fuel into heat energy.

(adopted from ***«mammal.»*** *Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

a high metabolic rate	under different conditions	secrete milk
warm-blooded	well-developed systems	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The females of all but the most primitive mammalian species bear their young alive.
2. Particularly well developed is the part of the brain that controls nourishing.
3. The mammalian brain does not enable the young to learn from the experience of their elders.

4. Whales are the most intelligent of all.
5. Mammals cannot sustain a constant body temperature.
6. The required fuel comes from food and oxygen.
7. Fuel is transformed into heat energy.

Exercise 4. Answer the following questions:

1. What does the term mammal come from?
2. What is the role of female glands?
3. What time are the young fed with milk?
4. What are the typical features of mammals?
5. What does behavioral adaptability mean?
6. How is climate-control system maintained?
7. What does it help?

Exercise 5. Match the words with their definitions.

1. creature	a. as a separate unit
2. apart	b. a created being
3. breast	c. a source of energy
4. gland	d. the portion of the central nervous system of vertebrate animals that is the organ of thought and the central control point for the nervous system, is enclosed within the skull, and is continuous with the spinal cord
5. brain	e. of or relating to the body
6. since	f. able to keep up a relatively high and constant body temperature that is mostly independent of that of the surrounding environment
7. warm-blooded	g. a cell or group of cells that makes and secretes a product (as saliva, sweat, bile, or shell) for further use in or for elimination from the plant or animal body
8. fuel	h. a constant ratio between two things
9. bodily	i. a state of being
10. condition	j. from a definite past time until now
11. rate	
12. inner	

Part 3

Birds

Just exactly what is a bird? Perhaps you would say that a bird is an animal that flies. But butterflies, which are insects, and bats, which are mammals, also fly. Some birds, on the other hand, do not fly at all. The ostrich, the emu, and the kiwi run very fast. The penguin swims with its short wings. None of them can fly.

All birds, however, have feathers, which no other living animal has, though paleontologists have found fossilized remains of a few dinosaurs and other reptiles—probably the ancestors of birds—that appear to have had feathers. Birds are feathered, warm-blooded animals with backbones. They have two legs. Whether they fly or not, all have a pair of wings corresponding to the arms or the front legs of many other animals. A beak takes the place of a jaw with teeth. All birds lay eggs. Most of them build a nest in which they care for the eggs and the young birds.

A bird's feathers provide the bird with protection from rain, cold, and heat. A robin or a chicken in a rainstorm will stand with wings and tail drooping to the ground. The water simply slides off without soaking through. On a cold winter day the bird fluffs out its feathers. In hot weather it flattens the feathers close to its body. When they are fluffed out they hold a layer of warm air next to the skin. When they are flattened they keep the skin cool by preventing hot air from reaching it. The entire covering of feathers is called the bird's plumage.

A feather has a main shaft that is stiff and solid. A hollow part at the base fits into the bird's skin. Barbs branch from the shaft and together compose the vane. Each barb in turn branches into smaller barbules. Tiny hooks, or hooklets, on the barbules lock all the neighboring barbules together. When a feather is ruffled the wrong way the hooks tear apart. When the feather is smoothed the hooks relock like a zipper.

*(adopted from **«bird.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

which are insects	hooklets	during cold winters	have feathers
build a nest			

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. All birds have wings and can fly.
2. Birds are feathered, warm-blooded animals without backbones.
3. Most of birds build a nest to lay eggs.
4. In winter birds fluff out their feathers to hold warm layer next to the skin.

5. Their plumage helps them in hot weather.
6. A feather does not have a hollow part.
7. Hooks work like a zipper.

Exercise 4. Answer the following questions:

1. What is a bird?
2. Who are supposed to be the ancestors of birds?
3. What do their wings correspond to?
4. What do feathers provide?
5. How do they provide this?
6. What is the structure of a feather?
7. What is the role of hooklets?

Exercise 5. Match the words with their definitions.

1. fly	a. rapidly
2. fast	b. to move in or pass through the air with wings
3. fossil	c. the bill of a bird ; esp: the bill of a bird of prey adapted for striking and tearing
4. remains	d. one from whom an individual, group, or species is descended
5. ancestor	e. to make or become flat
6. appear	f. a hard material which is largely calcium phosphate and of which the skeleton of most vertebrate animals is formed
7. bone	g. whatever is left over or behind — usually used in plural
8. beak	h. a trace or print or the remains of a plant or animal of a past age preserved in earth or rock
9. flatten	i. having no element or part left out
10. prevent	j. seem, look
11. entire	
12. ruffle	

Unit 3. Plants

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. Many shrubs and cacti thrive in deserts that go without rain for years at a time, and rivers, lakes, and swamps are filled with water plants.

b. Mosses and tussock grasses grow in Antarctica.
c. Wherever there is sunlight, air, and soil, plants can be found.
d. Flowers of vivid color and great variety force their way up through the snow on mountainsides.
e. On the northernmost coast of Greenland the Arctic poppy peeps out from beneath the ice.

Exercise 2. Fill in the gaps with the words from the box. Read the whole paragraphs.

shelter that described this indirectly on upon species provide is

The scientists who study plants—botanists—have named and (1)… approximately 270,000 different kinds of plants. They estimate that another 30,000 unidentified (2)… exist in less explored ecosystems such as tropical forests.

Human beings are completely dependent (3)… plants. Directly or (4)…, plants provide food, clothing, fuel, (5)…, and many other necessities of life. Humankind's dependence on crops such as wheat and corn (6)… obvious, but without grass and grain the livestock (7)… provide people with food and other animal products could not survive either.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. are essential parts/Plants/of ecosystems.
2. consumed/in ecosystems/plants and algae/is provided by/Most of the energy.
3. all organisms/soon/would run out of/Without them/food.
4. absorb/such as/from the soil/Plants/nitrogen/minerals/and phosphorus/potassium.
5. in plant tissues/an essential part/are stored/These/of the diet/and/eat plants/are/of animals/that.
6. help/enrich/soil/Plants/and stabilize/form.
7. break down/hearty mosses/crumble rock/The crusty, gray-green lichens/and/help/into soil/and.
8. the fertility of soil/increase/other decaying plant material/Leaves/and.
9. soil/and/erosion/stabilize/prevent/Plant roots.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1.	moss	a.	reasonably close to

2.	tussock	b.	any plant or plantlike organism (as a seaweed) that includes forms mostly growing in water, lacking a system of vessels for carrying fluids, and often having chlorophyll masked by brown or red coloring matter
3.	thrive	c.	to make a careful search
4.	explore	d.	to use as a customer
5.	consume	e.	any of a class of plants that have no flowers and produce small leafy stems forming sex organs at their tips and that grow in patches like cushions clinging to rocks, bark, or damp ground
6.	decay	f.	to grow vigorously, do well
7.	increase	g.	any of numerous plantlike living things made up of an alga and a fungus growing together on a solid surface (as a rock or a tree)
8.	lichen	h.	to make or become greater
9.	approximately	i.	to lose soundness, health, strength, or vigor
10.	erosion	j.	a compact bunch especially of grass or sedge
11.	prevent		
12.	algae		

(adopted from «plant.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2
Uses of plants

Human beings are completely directly or indirectly dependent upon plants. Plants are important and necessary for our life. Humankind depends on crops in agriculture, grass in farming, trees in building, etc.

The food that plants store for their own growth is also the food that humans and other organisms need in order to live. In North America the chief food plants are cereal grains. (The word cereal comes from Ceres, the Roman goddess of agriculture.) Major cereal crops include corn (maize), wheat, oats, rice, barley, rye, and buckwheat. Legumes are the second greatest source of food from plants. Legumes such as peas, beans, soybeans, and peanuts are high in protein and oil. Sago, taro, and cassava are major starchy foods in certain tropical parts of the world. Seaweeds, an important part of the diet in some cultures, especially in Asia, are not actually plants but rather are a form of algae.

Seasonings are derived from plant materials. People have used herbs and spices for centuries to flavor and preserve food. Some seasonings, such as pepper and nutmeg, are obtained from dried fruits. Others, including thyme, sage, and rosemary, come from leaves. Plant stems provide such spices as ginger and cinnamon.

Many beverages come from plants. Coffee, tea, and cocoa are prepared by steeping plants in hot water. Other drinks are «ready-made» by nature: orange, lemon, and grape juice; coconut milk; apple cider; and apricot nectar are examples. Some beverages come from processed plants, as do the cola drinks made from the kola nut of tropical America.

(adopted from «plant.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

in order to live	many plants	depends on	cereal grains	come from

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Humankind indirectly depends on plants.
2. Plants store the food for the own growth.
3. Cereals and seaweeds are widely used.
4. They are high in protein and oil.
5. Seasonings are used to flavor and preserve food.
6. Many drinks are made from processed plants.
7. Many of them are ready-made.

Exercise 4. Answer the following questions:

1. How are humans dependent on plants?
2. What are legumes?
3. Are algae used in some countries as a part of their diet?
4. What do people use herbs for?
5. What do spices come from?
6. Do humans process plants?
7. What does the word cereal mean?

Exercise 5. Match the words with their definitions.

1. fuel	a. a white odorless tasteless carbohydrate that is the chief form in which carbohydrate is stored in plants, is an important food, and is used also in adhesives, in laundering, and in pharmacy and medicine
2. survive	b. a material used to produce heat or power by burning
3. cereal	c. a plant growing in the sea
4. legume	d. the main stalk of a plant that develops buds and shoots and usually grows above the ground
5. starch	e. any of a large family of herbs, shrubs, and trees that have fruits which are dry single-celled pods that split into two pieces when ripe, that bear nodules on the roots that contain nitrogen-fixing bacteria, and that include important food plants (as peas, beans, or clovers)
6. seaweed	f. a plant (as a grass) that produces starchy grain suitable for food; also: its grain
7. derive	g. a liquid for drinking
8. stem	h. to remain alive, continue to exist
9. beverage	i. to change or prepare by special treatment
10. process	j. to receive or obtain from a source
11. seasoning	
12. preserve	

Part 3

Insect-eating plants

A number of plants are capable of eating small animals, especially insects. These plants are called insectivorous plants. Insectivorous plants employ a variety of mechanisms to catch their prey. The sundew has sticky glands located on the ends of hairs on its leaves. Insects become stuck and eventually entangled in these hairs and are then digested by chemicals released from the leaf. Pitcher plants have tubular leaves that produce chemicals attractive to insects. Once the insect has crawled inside the leaf, it is unable to escape. The Venus's-flytrap has perhaps the most elaborate mechanism for catching insects.

Venus's-flytrap is small plant found in the wild only in eastern North and South Carolina, where it is common in damp, mossy areas. The plant bears a round cluster of small white flowers at the tip of an erect stem that grows from 8 to 12 inches (20 to 30 centimeters) tall. The leaves are 3 to 5 inches (8 to 13 centimeters) long and form a rosette. Each leaf ends in two lobes that form a trap. Crimson glands give the lobes a red, flowerlike appearance to attract insects. The plant's traps are «set» only when the sun shines.

On the surface of each lobe are three highly sensitive hairs. In normal daytime temperatures, when these hairs are stimulated by an insect or by any other means, the lobes snap shut in about half a second. The spines along the edges interlock to hold fast the captive, and the glands on the lobes' surface secrete an acidic fluid that digests the insect's body.

About ten days are required for digestion, then the leaf reopens. A leaf rarely captures more than three insects in its lifetime. The scientific name of the Venus's-flytrap is Dionaea muscipula.

*(adopted from **«plant.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Exercise 1. Look through the text and copy out proper names and numerals. Put them in the order they appear in the text.

Exercise 2. What do the proper names and numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. All insectivorous plants use the same mechanism.
2. Chemicals are also used to attract insects.
3. Venus's-flytrap grows in damp, mossy areas.
4. It catches insects only when in the daytime.
5. Sensitive hairs make the plant' trap work.
6. It requires a week to digest the insects.
7. Then the leaf reopens again ready for another insect.

Exercise 4. Answer the following questions:

1. What does the term insectivorous mean?
2. What mechanisms do plants employ to catch their prey?
3. Can insects escape?
4. Where can Venus's-flytrap be found?
5. What is it like?
6. How does it digest its victims?
7. How many insects does it capture in its lifetime?

Exercise 5. Match the words with their definitions.

1. insect	a.	a cell or group of cells that makes and secretes a product for further use in or for elimination from the plant or animal body
2. prey	b.	having the power or quality of attracting
3. digest	c.	capable of responding to stimulation
4. attractive	d.	slightly wet moist
5. escape	e.	to convert food into simpler forms that can be taken in and used by the body
6. damp	f.	any of a class of arthropods (as butterflies, true bugs, two-winged flies, bees, and grasshoppers) with the body clearly divided into a head, thorax, and abdomen, with three pairs of jointed legs, and usually with one or two pairs of wings
7. gland	g.	a curved or rounded part ;
8. lobe	h.	to get away, to leak out from some enclosed place
9. sensitive	i.	to make a sudden closing
10. snap	j.	an animal hunted or killed by another animal for food
11. captive		
12. scientific		

*(adopted from **«Venus's-flytrap.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Unit 4. Animals

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraphs.

a. Animals display some key differences that distinguish them from other living things.
b. Even these rooted animals have parts that move in order to capture food.
c. Most animals move freely from place to place and can sense their surroundings; that is, they can taste, smell, hear, see, and touch.
d. The largest kingdom is the Animalia.
e. Its members range from very simple invertebrates, such as sponges, to highly complex mammals, such as whales, monkeys, and humans.
f. All living things are divided into five kingdoms.
g. Certain simple animals, such as the corals and barnacles, spend most of their lives fastened to one spot, but they are able to swim freely when they are young.

Exercise 2. Fill in the gaps with the words from the box. Read the whole paragraph.

of and by off an as up to the

All living things are made (1)… of cells of protoplasm. They may consist (2)… a single cell, as does (3)… amoeba, or billions of cells, (4)… do trees and horses. Animal cells are bounded (5)… a membrane composed chiefly of fat (6)… protein.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. Green/make/food/plants/their own.
2. and/With the aid of/called chlorophyll/use/in sunlight/carbon dioxide/into carbohydrates/other food materials/and/the green substance/they/the energy/to change/water.
3. contains/animal/No/true/chlorophyll.
4. must eat/either directly or indirectly/manufactured/of the plant kingdom/Animals/the food/by members.
5. in the sun/cannot/wait/to make/stand/fat and proteins/A horse/and/for its body.
6. move/in search/around the pasture/must/of green grass/It.
7. for example/live on animals/zebras/which/such as/in turn/Even/subsist on plants/meat eaters/lions.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. kingdom	a. someone or something that is of help or assistance
2. complex	b. to keep oneself alive
3. surroundings	c. land or a plot of land used for grazing
4. in order to	d. to set limits to
5. bound	e. a major category in the scientific classification of living things that ranks above the phylum and below the domain
6. aid	f. in an attempt to get, find, or seek out
7. pasture	g. the circumstances, conditions, or objects by which one is surrounded
8. in search	h. for the purpose of
9. live on	i. to have or get the necessities of life (as food and clothing), to nourish oneself
10. contain	j. having many parts, details, ideas, or functions often related in a complicated way
11. subsist	
12. fasten	

(adopted from ***«zoology.»*** *Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Part 2

Social behavior of animals

All living things relate to other members of their species. In an amoeba, the relationship occurs only during the short time it takes the animal to split into two animals. In other species, such as the social insects, the relationship is so necessary that they cannot survive as individuals. Social organization of some kind is common to all animals. However, the type of organization varies with the nervous system of the species.

Conspecifics, or animals of the same species, may at times be close to each other without exhibiting social behavior. For example, mollusk larvae may respond to changes in the intensity of light by swimming to the water surface. The resultant grouping, called an aggregation, stems from a common response to a physical aspect of the environment. But a response is truly social only when it is a response to visual, chemical, auditory, or other stimuli emanating from a conspecific. As a result of such stimuli, animals may approach each other to form a bond or to fight.

The type of bond formed by conspecifics is a measure of their nervous and hormonal systems. Organisms with relatively simple systems may respond to each other only as long as they give off attractive or offensive stimuli. For example, a worm will approach another worm during the reproductive state because certain chemicals are released. Once mating has occurred, they have nothing further to do with each other. A goby will remain near its eggs only as long as the hormonal state of the fish and the chemical and visual features of the eggs remain the same. Once the fry, or young, hatch, the fish responds to them as it would toward any small fish and tries to eat them. The goby does not recognize the fry as its own offspring.

(adopted from ***«animal behavior.»*** *Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

response to stimuli	survive	relate to	chemical features
nervous and hormonal systems			

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Splitting into two parts is the way simple organisms behave.
2. Social organization of some kind is not typical to all animals.
3. Mollusks respond to some changes swimming to the water surface.
4. It is truly social behavior.
5. An animal fighting is its reaction to offensive stimuli.
6. A goby respond to the chemical and visual features of the eggs.
7. The goby recognizes the fry as its own offspring.

Exercise 4. Answer the following questions:

1. How does relationship occur?
2. Does the type of organization vary?
3. How do some species exhibit their behavior?
4. What is a measure of their hormonal system?
5. How do organisms respond to stimuli?
6. Does the response differ in different systems?
7. What are conspecifics?

Exercise 5. Match the words with their definitions.

1. relationship	a. to show by outward signs
2. split into	b. to be different
3. common	c. to react in response

4. vary	d. a group, body, or mass composed of many distinct parts
5. conspecifics	e. to come out from a source
6. exhibit	f. to come near or nearer
7. respond to	g. to divide into
8. aggregation	h. to come into existence
9. emanate	i. belonging to or shared by two or more individuals or by the members of a group or set
10. approach	j. relating to or made or suited for attack
11. offensive	
12. occur	

Part 3

Feeding behavior of animals

Animals display a wide diversity in feeding behaviors and strategies. The hydra feeds most commonly on the larva of a kind of shellfish. It has a mouth surrounded with long tentacles. The tentacles sting and paralyze the prey and then shove it inside the mouth.

Birds and bats catch insects in flight. Woodpeckers hammer into the bark of trees for grubs, other birds comb the leaves with their bills for small insects, and hawks swoop down on rodents and on other birds.

Animals that eat other animals are called carnivores. The shark is a fierce carnivore. It lives on smaller fish, such as mackerel. Many mammals are carnivores. They all have special kinds of teeth for tearing their food into chunks and chewing it. Most of them have claws for catching and holding their prey. Among the carnivores are cats, dogs, raccoons, weasels, bears, hyenas, and civet cats.

A large group of animals are herbivores, which means they eat vegetation such as plants and algae. Many herbivores are prey of the carnivores. Insects are the dominant herbivores in most parts of the world, though they may be less conspicuous than plant-eating mammals and birds. Herbivorous mammals include horses, cattle, sheep, goats, rabbits, rodents, elephants, deer and antelope, and monkeys and apes.

A few mammals live on insects—moles, shrews, and hedgehogs, bats, armadillos, aardvarks, and anteaters. Many bird species are insect eaters, as are certain kinds of insects, such as ladybugs. Animals that feed on insects are called insectivores.

*(adopted from **«zoology.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

feeds on	surrounded with	less conspicuous
dominant herbivores	catching and holding their prey	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Hydra's tentacles sting and paralyze the prey.
2. Bats are insectivores.
3. Raccoons feed on other mammals.
4. Claws are used to catch and hold the prey.
5. Carnivores only live on herbivores.
6. Insects are typical insectivores.
7. There are some mammals that are insectivores.

Exercise 4. Answer the following questions:

1. Do animals display different feeding strategies?
2. How do most birds catch insects?
3. What animals are called carnivores?
4. Are all mammals carnivores?
5. What do herbivores feed on?
6. Are monkeys plant-eating mammals?
7. Are there mammals that live on insects?

Exercise 5. Match the words with their definitions.

1. display	a. to separate or pull apart by force
2. tentacle	b. a sharp usually slender and curved nail on the toe of an animal (as a cat or bird)
3. in flight	c. attracting attention
4. hammer into	d. any of an order of small mammals that are mostly insect-eating and active at night
5. carnivores	e. any of various long flexible structures that stick out usually around the head or mouth of an animal (as a jellyfish or sea anemone) and are used especially for feeling or grasping
6. tear	f. plant life or cover (as of an area)
7. claw	g. a flesh-eating animal
8. herbivores	h. plant-eating animal
9. vegetation	i. in an act or instance of passing through the air by the use of wings

10. conspicuous	j.	any of two families of large primates including the chimpanzee, gorilla, orangutan, and gibbon
11. apes		
12. insectivores		

<u>Unit 5. Vertebrates</u>

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. Vertebrates typically have bilateral symmetry in their skeleton and in their muscular, respiratory, nervous, circulatory, and urogenital systems.
b. They are distinguished from invertebrates, or backboneless organisms.
c. Animals with backbones are called vertebrates.
d. The earliest vertebrates developed in the sea and gradually evolved into land animals, though a few species returned to the water.
e. They include the most highly developed animals—fishes, amphibians, reptiles, birds, and mammals—among which are human beings, the highest of the primates. F.
f. Their two pairs of limbs are adapted for different uses, such as wings for flying or fins for swimming.

Exercise 2. Fill in the gaps with the words from the box. Read the whole paragraph.

distinct and almost lungs breast most protect with direct base

In (1)… vertebrates, a hollow, jointed backbone and its upper extension, the cranium, (2)… the spinal cord and brain. (3)… all young vertebrates have gill slits in their embryonic (4)…. In land vertebrates the gills develop into (5)…. All vertebrates reproduce sexually, (6)… males and females have (7)… characteristics.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. a classification system/begins/Scientists/with the concept of species/have devised/a group of animals/for vertebrates/that/can breed/at the lowest level/that/with one another/that is.
2. Related species/into a genus/are grouped/(plural, genera).
3. in ascending order/ phylum (plural, phyla)/ Related genera/order/form/of family/ larger categories.
4. for example/to the family Canidae,/belongs to/The domestic dog/and finally/ to the order Carnivora /to the phylum Chordata /to the species and genus of Canis familiaris /to the class of mammals/(made up of most meat-eating mammals)/(to which all vertebrates belong).

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. primate		any of an order of mammals that are characterized by hands and feet that grasp, a relatively large complex brain, and vision in which objects are seen in three dimensions and that includes human beings, apes, monkeys, and related forms (as lemurs and tarsiers)
2. evolve	b.	to produce by a process of evolution
3. few	c.	a bodily structure (as a tendon or nerve)
4. return	d.	to make or become suitable ; esp: to change so as to fit a new or specific use or situation
5. adapt	e.	a period or step in a process, activity, or development
6. fin	f.	an organ (as of a fish) of thin plates or threadlike processes for obtaining oxygen from water
7. cord	g.	not many
8. gill	h.	to come or go back
9. stage	i.	to form in the mind by new combinations or applications of ideas or principles
10. lungs	j.	a thin process on the outside of an aquatic animal (as a fish or whale) used in propelling or guiding the body
11. devise		
12. relate		

(adopted from ***«vertebrate.»*** *Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.*

Part 2

Reptiles

The Reptilia class of vertebrates became the first to live their entire life span on dry land. This evolutionary development was made possible by the hard eggshell, which protects the egg from drying out. The egg contains food that sustains the developing young until it hatches. These animals became so successful that during the Permian period, 280 to 230 million years ago, reptiles replaced amphibians as the dominant land-dwelling vertebrates. At present the Earth supports about 6,000 species of modern reptiles.

The major reptile groups are turtles and tortoises, Squamata (lizards and snakes), and Archosaurs (now-extinct dinosaurs and modern-day alligators and crocodiles). Lizards are widespread in the tropics where they occur in great variety from horned toads to the monitor lizard, which measures up to 13 feet (4 meters) in length, of the East Indies. Snakes developed from early lizards. Their primary characteristics are lack of limbs; movement by undulating the body and tail; a highly flexible skull and jaw that allows them to swallow their prey whole; and, in some families of snakes, poison glands and hollow fangs.

The dinosaurs were prominent between 180 and 75 million years ago and then mysteriously died out. Dinosaurs can be divided into Saurischia, Ornithischia, and Crocodilia groups. The Saurischia, or reptilelike dinosaurs, included the huge meat-eater Tyrannosaurus rex and the largest plant eater Diplodocus, a four-legged reptile that weighed up to 50 tons. Some of the Ornithischia were two-legged animals, but most walked on all fours. They were all plant eaters and had a variety of defenses against the giant carnivores.

Modern-day alligators and crocodiles are the only surviving members of the Archosaurs.

*(adopted from **«vertebrate.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.*

Exercise 1. Look through the text and copy out proper names and numerals. Put them in the order they appear in the text.

Exercise 2. What do the proper names and numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Reptiles were the first vertebrates on the Earth.
2. Their eggs contain everything the young need.
3. Now reptiles are land-dwelling vertebrates.
4. Snakes lack limbs, jaws and skull.
5. They cannot swallow their prey.
6. They use poison from poison glands.
7. Dinosaurs were carnivores.

Exercise 4. Answer the following questions:

1. What does the eggshell protect the egg from?
2. How many species of reptiles are known?
3. Where do lizards live?
4. What are the main characteristics of snakes?
5. How were dinosaurs related to reptiles?
6. What were they like?
7. Were they herbivores?

Exercise 5. Match the words with their definitions.

1. span	a. to keep something going
2. hard	b. capable of being bent
3. contain	c. to be missing
4. hatch	d. to live in a place
5. dwell	e. a limited portion of time
6. support	f. to come into existence
7. occur	g. to emerge from an egg, pupa, or chrysalis
8. lack	h. to consist of
9. flexible	i. the act of defending
10. fang	j. not easily penetrated, cut, or divided into parts: not soft
11. prominent	
12. defence	

Part 3

Reproduction

All animals can reproduce, creating offspring of their own kind. Some animals reproduce asexually, in which a partner is not needed. Sea squirts, for example, reproduce by budding: lumps appear along a branchlike organ and develop into young sea squirts. Sea squirts, sponges, corals, and other organisms that bud often remain together and form large colonies.

In sexual reproduction, a male and a female organism each contribute toward creating offspring. Most animals reproduce by means of eggs from the female that are fertilized by sperm from the male. The eggs of some species are deposited in a nest or in some other manner before hatching. Most species of mammal and some species of reptile and fish bear their young alive, the fertilized eggs being retained within the body of the female.

The types of reproductive behavior among animals are almost as varied as the kinds of animals themselves. Some species, such as most insects and turtles, deposit their eggs and give them no further attention. In colonies of the social insects, such as ants and bees, a single female lays all of the eggs, and workers provide care and nourishment for the developing young in the nest. The females of some reptiles, such as the king cobra and the blue-tailed skink, and amphibians, such as the marble salamander, stay with their clutch of eggs until they hatch but provide no protection or nourishment for the young. Some fish guard their young after they are born. Crocodilians protect the eggs before hatching and the young for several months afterwards. Many birds provide not only protection but also nourishment for the developing young. Mammals provide care for their young much longer than do other classes of animals.

*(adopted from **«animal.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

male and female organism remain together provide protection and nourishment most insects and turtles types of reproduction

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. All animals are able to create offsprings.
2. Animals cannot reproduce by budding.
3. Most reptiles reproduce by means of eggs.
4. Insects live in social colonies.
5. Snakes do not stay near their eggs until they hatch.
6. Many species provide nourishment for their young.
7. Both male and female organisms make a contribution in asexual reproduction.

Exercise 4. Answer the following questions:

1. How do animals reproduce?
2. Which animals live in large colonies?
3. What happens in sexual reproduction?
4. Do types of reproduction vary?
5. How do insects reproduce?
6. What do birds provide for their young?
7. How are mammals different?

Exercise 5. Match the words with their definitions.

1. create	a. to stay in the same place
2. need	b. to hold secure or unchanged
3. lump	c. to move while holding up and supporting
4. branch	d. of, relating to, or being the sex that produces gametes which fertilize the eggs of females
5. remain	e. a small uneven mass
6. male	f. to unite with in the process of fertilization
7. bear	g. to bring into existence
8. fertilize	h. a natural division of a plant stem (as a bough growing from a trunk or twig from a bough)
9. retain	i. to supply what is needed for support
10. deposit	j. to be in need of
11. provide	
12. care	

Unit 6. Invertebrates

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. The most familiar kinds are the sponges.
b. Several types of cells are present, but each generally functions as a unit without forming tissues, as in more complex metazoans.
c. They are called pore bearers because they are covered with millions of tiny holes.
d. These multicellular animals are sometimes referred to as metazoans, to distinguish them from the protozoans—single-celled and simple multicelled organisms that once were classified as animals but now belong to the kingdom Protista.
e. The simplest animals make up the phylum Porifera («pore bearers»).
f. All members of the kingdom Animalia are multicellular—that is, all have bodies composed of many cells.
g. Water flows through the holes, and from the water the sponges take in oxygen and the tiny waterborne organisms that constitute their food and filter out wastes.
h. Sponges have no mouth or digestive cavity, no nervous system, and no circulatory system.

Exercise 2. Fill in the gaps with the words from the box. Read the whole paragraph.

term phylum structure layer structural among protects tissue word provides

The next, less primitive (1)… pattern in invertebrates is a hollow gut. The representative (2)… is Coelenterata, a (3)… stemming from the Greek words koilos (hollow) and enteron (intestine). (4)… the coelenterates are the corals, hydras, jellyfishes, and sea anemones. The body is composed of two (5)… layers. The inner (6)…, or endoderm, lines the central digestive cavity. The outer layer, or ectoderm, (7)… the animal externally.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. a mouthlike opening/that/waste material/have/the only opening/in food/ejects/The coelenterates/and/into the gut.
2. protective structures/and/stinging cells/such as/Food-gathering organs/tentacles/such as/surround the mouth.
3. nervous system/is/There/primitive/a.
4. sometimes/cnidarians/also/Coelenterates/are/called.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. sting	a. a hollow place ; esp: an unfilled bodily space
2. hole	b. being near a center especially of influence
3. refer	c. the opening through which food passes into the body of an animal
4. distinguish	d. frequently seen or experienced
5. familiar	e. a springy mass of fibers and spicules that forms the skeleton of a group of aquatic animals and is able to absorb water freely
6. cavity	f. having a binding
7. tissue	g. to have relationship
8. bound	h. to recognize one thing from others by some mark or quality
9. inner	i. of, relating to, or connected with the outside or an outer part
10. external	j. an opening into or through a thing
11. mouth	
12. sponge	

*(adopted from **«invertebrate.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Part 2
Flatworms

The flatworms (phylum Platyhelminthes) comprise more than 10,000 flat, elongate species. The three taxonomic classes in the phylum are the free-living (nonparasitic) flatworms, the flukes, and the tapeworms. Flatworms are among the most primitive bilaterally symmetrical (having a body with two identical halves) animals.

Many flatworms have cilia (movable, bristlelike structures) on their outer surface that aid in locomotion and feeding. Flatworms have well-developed tissue layers and simple organ systems. In the simplified digestive system, cilia move food particles to specialized cells that consume them. Nerves are present, terminating as a bundle in the anterior part of the body and constituting a primitive central nervous system. Flatworms lack true skeletal, circulatory, and respiratory systems.

Even though they lack complex organs or systems, the flatworms display a wide variety of forms and occupy many habitats. The free-living flatworms are mostly marine, although some live in fresh water and some are terrestrial. The planarian, which is used in elementary biology classes to demonstrate a primitive response to light, is one of the best-known of the flatworms.

The other class of parasitic flatworm is the tapeworm. Adults of this class inhabit the intestinal tract of vertebrates. Tapeworms attach to the intestinal wall by means of hooks or suckers located on their heads and absorb nutrients across their cell walls directly from the host's food as it passes through the intestine. The tapeworm body is a series of separate reproductive sacs called proglottids.

*(adopted from **«invertebrate.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

to demonstrate a primitive response	food particles	many habitats
lack complex organs	simplified digestive system	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Flatworms are symmetrical animals.
2. They lack nervous system.
3. Their digestive system works with the help of cilia.
4. Flatworms inhabit mostly in the sea.
5. Some live in tracts of other animals.
6. Proglottids attach to animals skin by means of hooks.
7. All flatworms have complex organs.

Exercise 4. Answer the following questions:

1. How many species of flatworms are known?
2. What are flatworms?
3. What is the role of cilia?
4. Do they have respiratory system?
5. What can be habitats of flatworms?
6. Do they respond to stimuli?
7. How do they absorb nutrients?

Exercise 5. Match the words with their definitions.

1. comprise	a. a fully grown person, animal, or plant
2. elongate	b. properly so called
3. free	c. to make clear the existence or presence of
4. halves	d. to eat or drink up
5. consume	e. stretch out

6.	true	f.	the place or type of place where a plant or animal naturally or normally lives or grows
7.	display	g.	not fastened
8.	habitat	h.	plural of half
9.	adult	i.	to fasten or join one thing to another
10.	sucker	j.	to be made up of
11.	attach		
12.	pass		

Part 3
Mollusks

The mollusks (phylum Mollusca) consist of about 75,000 species, most of which have shells. Included in the phylum are the octopuses and squids. A major distinguishing characteristic of mollusks is the presence of a coelom. The coelom is the cavity in the body that contains the digestive tract and certain vital organs such as the heart and liver. A true coelom is lined entirely with mesodermal tissue and has no ectoderm or endoderm. Although oysters and snails superficially appear simple in structure, they and other mollusks have well-developed digestive, excretory, respiratory, circulatory, and nervous systems.

Gastropods make up the largest class of mollusks. These include the many forms of terrestrial and aquatic snails. Aquatic gastropods have gills, whereas land snails have a lunglike structure known as a mantle that is contained within the mantle chamber. Most gastropods have a large muscle mass called a foot that extends from the shell and permits them to move about on the land or ocean floor.

Bivalve mollusks, or pelecypods, make up the second-largest class. They have a pair of hinged shells that can be closed for protection but opened for feeding. Most bivalves, such as oysters, mussels, and clams, are marine organisms that move about very little if at all during their adult lives. They obtain food by filtering water through their gills and extracting suspended particles. Their eggs are released in prodigious numbers, and the tiny larvae often settle on sites many miles from the parents.

*(adopted from **«invertebrate.»** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

Make up	marine organisms	included in the phylum
have shells	well-developed systems	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?
1. Mollusks have the heart and liver.
2. They are simple organisms.
3. There two major classes.
4. Some mollusks have lunglike structures.
5. They also have muscles.
6. Mollusks feed on small suspended particles.
7. Mussels move a lot in their lifetime.

Exercise 4. Answer the following questions:
1. What are mollusks characterized with?
2. What is a true coelom?
3. Do they lack circulatory system?
4. What do mollusks inhabit?
5. What helps their locomotion?
6. How do marine mollusks obtain food?
7. How do they reproduce?

Exercise 5. Match the words with their definitions.

1.	shell	a.	growing or living in or often found in water
2.	presence	b.	the joint between valves of a bivalve's shell
3.	vital	c.	to cover or surround with or as if with a mantle
4.	liver	d.	any of numerous small mollusks that are gastropods usually with a spiral shell and that include some living on land and others living in water
5.	snail	e.	the outer covering of an egg
6.	aquatic	f.	an enclosed space
7.	mantle	g.	concerned with or necessary to the continuation of life
8.	chamber	h.	to nourish or become nourished as if by food
9.	hinge	i.	get
10.	feed	j.	the fact or state of being present
11.	obtain		
12.	suspend		

Unit 7. Variety of Species

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. The changes resulted in the great diversity of life we see today.
b. Ancient organisms first arose around 3.5 billion years ago, roughly a billion years after the Earth was formed.
c. Over time, the Earth underwent geologic and atmospheric changes, which caused some animals to die out, others to thrive, and others to adapt to the changed environment.

Exercise 2. Fill in the gaps with the words from the box. Read the whole paragraph.

include cord most other from form made arose earliest others

Exactly when and how the animal kingdom evolved (1)… the earliest simple life forms to the diversity we see today are questions that continue to challenge scientists. What is clear is that at some point hundreds of millions of years after the earliest animals evolved, a group of animals (2)… that had the beginnings of an internal skeleton and a rudimentary backbone, a semiflexible structure (3)… of cartilage called a notochord. These animals were called the chordates. In addition to their rudimentary backbones, the chordates also had a crude (4)… of nervous tissue running along their backs—the forerunner of our spinal cords. Within this group arose a subgroup of animals with an internal skeleton and spine made of bone. This latter group included the (5)… vertebrates. Today, vertebrates are among the most familiar animals. They (6)… the mammals, reptiles, birds, fish, and amphibians. The (7)… major branch of the animal kingdom consists of the invertebrates—animals without backbones. They include insects, sponges, corals, jellyfish, clams, lobsters, and starfish.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. only/about 5 percent/The vertebrates/of all animal species/make up.
2. the remaining 95 percent/make up/Invertebrates.
3. There/4,500 species/some/are/of mammals.
4. represents/the total number/though/have been described/More than/scientists/that/1 million insect species/far less/than.
5. this/insects/within the animal kingdom/Still/makes/the largest group.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. arose	a. fundamental
2. exactly	b. in the class of
3. ancient	c. require
4. continue	d. of or relating to a period of time long past
5. ascend	e. past of arise
6. basic	f. having qualities in common
7. involve	g. to go up
8. range	h. to go on or carry on after an interruption
9. among	i. strictly accurate
10. proper	j. quite so
11. distinction	
12. similar	

*(adopted from **«animal.** Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Part 2

How classification shows relationships

Classification shows relationships between animals in an increasingly specific order, from remotely related members of the same phylum to closely related species within a genus. House cats (Felis catus) and bobcats (Felis rufus) belong to the same genus (Felis) and family (Felidae) but to different species.

Dogs and cats do not appear to be related. Both, however, have backbones and are meat-eating mammals. Hence they belong to phylum Chordata (having a spinal cord), class Mammalia (mammals), and order Carnivora (flesh eaters); because of differences between them, however, they belong to separate families (dog, Canidae; cat, Felidae).

Whales and sharks both appear to be kinds of fish. Both are strong, streamlined swimmers of the sea. However, the whale is a mammal. It has lungs and is warm-blooded, gives birth to live young, and nurses its offspring with milk. Whales therefore belong to the class Mammalia. The shark, on the other hand, is a primitive kind of fish with a skeleton of cartilage instead of bone. Sharks, whales, and true fishes all have a backbone. Thus, they are placed in the same phylum (Chordata) and subphylum (Vertebrata). Sharks and fishes, however, are also in different classes, the sharks being in the Chondrichthyes and the true fishes in the Osteichthyes.

Classification also suggests which kinds of animals may have descended from other types. All multicelled animals, for example, are supposed to be de-

scendants of one-celled animals. This does not mean descent from one living kind of animal to another, however. All living animals are believed to have descended from common ancestors that were less specialized than they. These relationships may be shown on a treelike diagram called a phylogenetic tree. The word phylogenetic comes from two Greek words meaning «race history.»
(adopted from ***«animal.»*** *Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)*

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

phylogenetic tree	kind of animal	belong to separate families
have a backbone	to be related	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?
1. Classification helps to find conspecifics and descendants.
2. All backbones belong to the same class.
3. All backbones are carnivores.
4. Whales lack respiration system.
5. All fishes are placed in the same class.
6. All mammals have different ancestors.
7. Phylogenetic tree shows the structure of digestive system.

Exercise 4. Answer the following questions:
1. What does classification show?
2. How are cats and dogs related?
3. What is the difference between whales and sharks?
4. What skeleton do sharks have?
5. What is the relation between uni and multicelled organisms?
6. What does the term phylogenetic mean?
7. What language is used in classification?

Exercise 5. Match the words with their definitions.

1. show	a.	any of numerous marine fishes that have rough grayish skin and a skeleton made of cartilage, that usually prey on other animals and are sometimes dangerous to people, and that include some caught for the oil in their livers or for their hide from which a leather is made
2. specific	b.	to assign to a position in a series or category
3. genus	c.	a woody plant that lives for years and has a usually single tall main stem with few or no branches on its lower part

4. belong	d.	a water-dwelling mammal that is a cetacean of usually very large size with a torpedo-shaped body, front limbs modified into flippers but no hind limbs, and a tail flattened and extended to the sides as flukes and that usually breathes through an opening on top of the head
5. whale	e.	to feed at the breast
6. shark	f.	the young of a person, animal, or plant
7. nurse	g.	category of classification in biology that ranks between the family and the species, contains related species, and is named by a capitalized noun formed in Latin
8. offspring	h.	to be classified
9. place	i.	to give indication or record of
10. suggest	j.	relating to or being an example of a certain kind of thing
11. tree		
12. race		

Part 3

Animal taxonomy and systematics

They involve the evolutionary history of a group of organisms and its position in relationship to other animals. A species is a group of organisms that interbreed naturally among themselves. Systematics is the science of classifying species in terms of their natural evolutionary origins and relationships. Taxonomy is the process of assigning organisms scientific names that are based on these relationships.

To name an animal, taxonomists use a system of nomenclature based on ascending levels of classification. These basic levels are species, genus, family, order, class, and phylum. Each species of animal is given a scientific name, called a binomial. The binomial consists of a genus name and a species name and refers to all members of a particular species.

Genera (plural of genus) that are closely related are placed in the same family, and families that have a similar evolutionary history are placed in the same order. All of the animals that are in related orders are grouped into classes, and similar classes are placed in the same phylum. All of the phyla (plural of phylum) of animals are in the animal kingdom.

Modern systematics involves the use of numerous techniques, ranging from the comparison of basic anatomical differences and similarities among animals to the use of biochemical genetics. The proper classification of animals is a major concern in zoology because each species or higher taxonomic group has characteristics that distinguish it from all others. Knowledge of these distinctions is sometimes critical to understanding certain zoological phenomena, such as whether animals from different geographic regions are similar because of a close ancestral relationship or because of independent adaptation to a similar environment.

(adopted from «zoology.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

understanding zoological phenomena	have features
ascending levels of classification	a system of classifying
distinguish it from all others	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. It assigns scientific names.
2. There are six basic levels.
3. Systematics classifies all species.
4. Animals of the same family are closely related.
5. They are able to interbreed and reproduce.
6. Anatomical and biochemical differences are involved in the process of systematics.
7. Animals from different geographic regions are similar.

Exercise 4. Answer the following questions:

1. What do taxonomy and systematics show?
2. What system is used in taxonomy?
3. What is binomial?
4. Which animals are placed in the same order?
5. What is genus?
6. Which organisms interbreed?
7. Why is knowledge of differences and similarities critical?

Exercise 5. Match the words with their definitions.

1. assign	a. any of a kingdom of living things composed of many cells typically differing from plants in capacity for active movement, in rapid response to stimulation, in being unable to carry on photosynthesis, and in lack of cellulose cell walls
2. base	b. a state of interest and uncertainty
3. term	c. a written record of important events and their causes
4. level	d. of or relating to the separate parts of a whole
5. particular	e. to give a certain quality, role, or importance to
6. animal	f. greater in dignity, rank, or importance
7. history	g. a word or expression that has an exact meaning in some uses or is limited to a particular field
8. major	h. a step or stage in a scale or rank
9. concern	i. not to be doubted : known to be true
10. critical	j. to make, form, or serve as a base for
11. certain	
12. close	

2. READING ROOM FOR STUDENTS OF GEOGRAPHY

<u>Unit 1. Geography</u>

Part 1

Exercise 1. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

The arrangement of things / on maps / over the Earth / and /between two or more areas / with clarity and simplicitys / can be presented / the interactions.

Although maps / essential tool / they become / are used / the one constantly/ in many other studies / in geography.

Exercise 2. Fill in the gaps with the words from the box. Read the whole paragraph.

the analytical map	seismograph	the reference map	mathematical
physical	the analytical map	are used	mostly

Three kinds of maps are important. They are (1) …, which may be used like an encyclopedia as a source of information; (2) …, which shows the distribution of specific phenomena or the spatial correlation of two or more phenomena on the Earth's surface; and (3) …, which suggests ideas that can be tested by (4) … and statistical techniques. The third type of map is used (5)… by professional geographers in their research. The reference and illustrative maps (6)… in everyday affairs.

Exercise 3. Put the sentences into the proper order. Read the whole paragraph.

a. A road map is a good example of a reference map.
b. Trade maps are of this kind.
c. Each of these abilities is described in the article Maps and Globes.
d. Drivers refer to such maps to find out how to get from one place to another.
e. The weather map reproduced in daily newspapers is a good example of an illustrative map.

f. These are the ability to locate places, to ascertain directions, to measure distances, and to interpret the mapmaker's symbols.
g. It shows how temperatures, precipitation, winds, and pressure are related in space.
h. Many other reference maps are published by commercial firms.
i. Illustrative maps also may show connections among various parts of the Earth.
j. To make and to read maps involve several abilities.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word with its definition.

1. precipitation	a. a device (as a hammer, saw, knife, or wrench) used or worked by hand or by a machine
2. interaction	b. to learn with certainty
3. pressure	c. water or the amount of water that falls to the earth as hail, mist, rain, sleet, or snow
4. space	d. the action or influence of people, groups, or things on one another
5. research	e. a fact, feature, or event of scientific interest
6. locate	f. the action of a force against an opposing force
7. ascertain	g. the degree of hotness or coldness of something (as air, water, or the body) as shown by a thermometer
8. map	h. the region beyond the earth's atmosphere
9. techniques	i. careful study and investigation for the purpose of discovering and explaining new knowledge
10. temperature	j. a drawing or picture showing selected features of an area (as the surface of the earth or the moon or a section of the brain) and usually drawn to a given scale
11. phenomena	
12. tool	

(adopted from «geography.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Different kinds of geography

The distribution of things on the face of the Earth can be investigated and analyzed in either of two ways. One approach is called topical geography, or sometimes systematic geography. The other approach is called regional geography.

Topical geography may be focused on physical or human phenomena. Analysis of the distribution of landforms, climates, water, soils, minerals, and similar factors is called physical geography. Certain aspects of this branch, in turn, are sometimes studied separately.

Topical geography may also be centered on the distribution of some human phenomenon. The analysis of the distribution of man's productive occupations, such as farming, mining, and manufacturing, is generally known as economic geography. In this field there are such specialties as the geography of agriculture, geography of manufacturing, transportation geography, and commercial geography.

Political geography emphasizes the pattern of the Earth's political sovereignties. Social geography includes the study of the dispersion of population and other factors, such as the distribution of the various religions.

A specialized field of topical geography, known as urban geography, is devoted to analyzing the distribution of cities and of things within cities.

In regional geography analysis is concentrated on associations which give character to a particular area. The area may be continental in size, or it may be subdivided into units such as countries, states, and counties. Subdivisions of the world that are made on the basis of similarities of human life provide culture regions.

(adopted from «geography.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out branches of science.

Exercise 2. In what context are and branches of science mentioned?

Exercise 3. Are the following statements true or false?

1. The distribution of things on the face of the Earth can be investigated and analyzed in either of four ways.
2. Topical geography may be focused on physical or human phenomena.
3. Analysis of the distribution of landforms, climates, water, soils, minerals, and similar factors is called geology.
4. The analysis of the distribution of man's productive occupations, such as farming, mining, and manufacturing, is generally known as physical geography.
6. Political geography emphasizes the pattern of the Earth's political sovereignties.
6. Social geography includes the study of the dispersion of population and other factors, such as the distribution of the various religions.
7. Urban geography is devoted to analyzing the distribution of cities and of things within cities.

Exercise 4. Answer the following questions:

1. How can the distribution of things on the face of the Earth be investigated and analyzed?
2. What may topical geography be focused and centered on?
3. What is physical geography?
4. How is the analysis of the distribution of man's productive occupations known?
5. What is political geography?
6. What does social geography include?
7. What is urban geography?

Exercise 5. Match the word with its definition.

1. mineral	a. the average weather conditions of a particular place or region over a period of years
2. mining	b. the taking possession and control of an area
3. water	c. the position, arrangement, or numbers (as of the members of a group) over an area or throughout a space or unit of time
4. climate	d. the occupation or business of a person who farms
5. landform	e. the making of products by hand or machinery
6. approach	f. the process or business of working mines
7. distribution	g. a natural feature of a land surface
8. farming	h. to study by close examination and systematic inquiry
9. agriculture	i. the liquid that descends from the clouds as rain, forms streams, lakes, and seas, and is a major part of all living material and that is an odorless and tasteless compound having two atoms of hydrogen and one atom of oxygen per molecule
10. investigate	j. a solid chemical element or compound (as diamond or quartz) that occurs naturally in the form of crystals and results from processes not involving living or once-living matter
11. manufacturing	
12. occupation	

Part 3
History

The earliest geographers were actually surveyors and mapmakers, but in ancient Greece, where geography as a discipline really began to emerge, they were natural philosophers with a broad range of knowledge and talents. The best known of the ancient scholars was Strabo (64BC?-AD 23?), a Greek historian and geographer. His 'Geography' is the only existing work covering the peoples and countries known to the Greeks and Romans.

During the Age of Discovery, beginning in the 15th century, geography experienced a new birth after centuries of neglect. Geographers provided the impetus for many expeditions and vastly increased the world's knowledge about itself. By the 18th century, however, governments and learned societies had taken over the sponsorship of exploration and had replaced geographers with professional surveyors and mapmakers—as in the earliest times.

At about the same time, two Germans—Alexander von Humboldt and Carl Ritter—were the first to write and teach as academic geographers. Since their day most geographers have been scholars, scientists, and teachers. Geography, through the efforts of such organizations as the Royal Geographical and American Geographical societies, has become firmly established as an academic discipline. The knowledge, techniques, and skills of trained geographers have also made their services valuable to many outside the academic world. Many governmental and business agencies employ geographers as planners, researchers, consultants, and scientists.

In the latter part of the 20th century, geography has been characterized by several trends. One is specialization. Geography has always combined the work of many disciplines, but today's geographer is more likely to be an expert in only one aspect than in the subject as a whole. Thus there are agricultural geographers, climatologists, arid zone specialists, and so on.

(adopted from «geography.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names.

Exercise 2. In what context are the proper names mentioned?

Exercise 3. Are the following statements true or false?

1. The best known of the ancient scholars was Strabo, a Greek historian and geographer.
2. During the Age of Discovery, beginning in the 17th century, geography experienced a new birth after centuries of neglect.
3. Geography, through the efforts of such organizations as the Royal Geographical and American Geographical societies, has become firmly established as a political discipline.
4. The knowledge, techniques, and skills of trained geographers have also made their services valuable to many outside the academic world
5. Many governmental and business agencies employ geographers as planners, researchers, consultants, and scientists.
6. In the latter part of the 20th century, geography has been characterized by many trends.

7. Geography has always combined the work of many disciplines.

Exercise 4. Answer the following questions:

1. Who were natural philosophers with a broad range of knowledge and talents?
2. Who was the best known of the ancient scholars?
3. When did geography experience a new birth after centuries of neglect?
4. What did geographers provide?
5. Who were the first to write and teach as academic geographers?
6. How do many governmental and business agencies employ geographers?
7. When has geography been characterized by several trends?

Exercise 5. Match the word with its definition.

1. mapmaker	a. a science that deals with the location of living and nonliving things on earth and the way they affect one another
2. scholar	b. a science that deals with climates
3. consultant	c. a general tendency or movement
4. scientist	d. cartographer
5. ancient	e. a journey or trip undertaken for a specific purpose
6. surveyor	f. an organization that pays for or plans and carries out a project or activity
7. government	g. a person who has done advanced study in a special area
8. sponsorship	h. a person who gives professional advice or services
9. expedition	i. person skilled in science and especially natural science
10. climatology	j. of or relating to a period of time long past
11. trend	
12. geography	

Unit 2. Meteorology

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. These include a gradual warming trend since the early 1700s, marked by a general retreat of mountain glaciers and polar pack ice.
b. Evidence from rocks and fossils shows that temperatures on the Earth have generally fallen in the past 200 million years, reaching a low during the ice ages of the Pleistocene epoch, from 2 million to 10,000 years ago.
c. Changes in climate over many millions of years have been extremely great.
d. Evidence from silt and clay deposits and tree growth rings reveals more recent changes.

Exercise 2. Fill in the gaps with the words from the box. Read the whole paragraph.

average	carbon dioxide	climate	fossil fuels	
heat	ozone	radiation	volcanic activity	dust

There are various theories that attempt to explain changes in climate. One theory is that there have been variations in the amount of (1) … radiated from the sun. Another is that huge quantities of (2) …, put into the atmosphere during periods of intense (3) …, have decreased the amount of solar (4) … reaching the Earth. Another is that increased amounts of (5) …, water vapor, and ozone—from volcanoes and from plants as well—have absorbed more of the sun's heat and thus raised (6) … temperatures. The addition of carbon dioxide to the atmosphere as a result of burning an ever-increasing amount of (7) … may cause global warming of atmosphere and oceans and extreme changes in climate.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. and in the average / and water surfaces / climate changes / elevation of the land / Geographical theories / in the distribution / of land / relate / to changes.
2. According / are shown to have shifted / for example / of continental drift / of major landmasses / the latitudinal positions / to the theory.
3. Astronomical theories / deal / from the sun / in the Earth's distance / in the location / in the tilt / of the Earth's axis / of the poles, and / shifts / variations / with possible changes.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word with its definition.

1. clay	a. a trace or print or the remains of a plant or animal of a past age preserved in earth or rock
2. condense	b. a time of widespread glaciation
3. cumulonimbus	c. an earthy material that is sticky and easily molded when wet and hard when baked
4. fossil	d. a layer of wood (as an annual ring) produced during a single period of growth
5. growth ring	e. sea ice formed into a mass by the crushing together of chunks and sheets of ice
6. hail	f. a small amount of liquid that causes moistness
7. ice age	g. to become or cause to become agitated and confused
8. flurry	h. to change from a less dense to a denser form
9. moisture	i. a cumulus cloud that has a low base and that is often spread out in the shape of an anvil extending to great heights
10. pack ice	j. small lumps of ice that fall from clouds sometimes during thunderstorms
11. rock	
12. silt	

(adopted from «climate.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Precipitation and Types of Storms

When warm, moist air cools to its dew point, condensation occurs if there are dust particles or salt crystals to serve as nuclei of condensation. When moist air is lifted by the collision of warm and cold air masses or by movement up a mountain slope, cooling and condensation result in extensive precipitation. In thunderstorms, updrafts hurl raindrops up and up again until they are heavy enough to fall. A hailstone grows like a raindrop, as it is exposed alternately to temperatures below and above freezing before it falls to the ground. Sleet is frozen rain.

If air is lifted above the freezing level aloft, the moisture may condense as ice crystals. When ice crystals invade a supercooled cloud, the water vapor condenses on them, forming snow crystals. As a snow crystal floats into lower, warmer air it joins with other snow crystals and becomes a snowflake. Snow flurries are caused by sudden cooling as a cold front moves in. Snowstorms occur when a flow of polar air lifts a warm air mass and when the mean temperature of the air through which the snow falls is below freezing. Big storms occur when the two air masses are blocked by a dawdling high.

When hot, moist air is carried above the freezing level by the strong updraft in a cumulonimbus cloud, thunder and lightning occur along with strong gusts of wind, heavy rain, and sometimes hail. This is a thunderstorm. The West Indies hurricane and the Pacific typhoon, powerful storms with torrential rains and winds of 75 miles per hour or more, originate over tropical seas in late summer and early fall when surface temperatures are highest and tropical air reaches farthest from the equator.

The tornado has a narrow, funnel-shaped trunk that reaches down from a dark thundercloud and whirls at speeds up to 300 miles per hour. A tornado moves to the northeast in the Northern Hemisphere, to the southeast in the Southern Hemisphere. Tornadoes appear most frequently in spring and early summer when cold, dry air flows over the Rocky Mountains and overrides the warm, moist air flowing from the Gulf of Mexico. Turbulence is caused by the sinking cold air and rising warm air.

(adopted from «climate.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numbers.

Exercise 2. In what context are the proper names and numbers from Exercise 1 mentioned?

Exercise 3. Look through the text and define which of the following keywords are mentioned in it.

sleet engineering hurricanes and typhoons flood prevention moist air

Exercise 4. Are the following statements true or false?

1. In thunderstorms, updrafts hurl ice crystals up and up again until they are heavy enough to fall.
2. The water vapor condenses on ice crystals and forms snow crystals.
3. As a cold front moves in, sudden cooling causes snow flurries.
4. When hot, moist air is carried above the freezing level by the strong updraft in a cumulonimbus cloud, thunder and lightning never occur, as well as strong gusts of wind, heavy rain, and hail.
5. The West Indies hurricane and the Pacific typhoon, powerful storms with torrential rains and winds of 75 miles per hour or more, originate over polar seas in late summer and early fall when surface temperatures are highest and cold air reaches farthest from the pole.
6. The tornado has a narrow, funnel-shaped trunk that reaches down from a dark thundercloud and whirls at speeds up to about 500 km per hour.

7. Tornadoes appear most frequently in spring and early summer when cold, moist air flows over the Rocky Mountains and overrides the warm, dry air flowing from the Gulf of Mexico.

Exercise 5. Answer the following questions:

1. When does condensation occur?
2. What happens when air is lifted above the freezing level aloft?
3. How are snowflakes formed?
4. What types of storms are mentioned in the text?
5. What is a thunderstorm?
6. Where do the West Indies hurricane and the Pacific typhoon originate from?
7. What do you know about tornados?

Exercise 6. Match the word with its definition.

1. dew point	a. a small lump of hail
2. slope	b. frozen or partly frozen rain
3. thunderstorm	c. fine dry powdery particles (as of earth)
4. precipitation	d. a storm accompanied by lightning and thunder
5. snowflake	e. a hurricane occurring in the region of the Philippines or the China Sea
6. hailstone	f. water or the amount of water that falls to the earth as hцail, mist, rain, sleet, or snow
7. hurricane	g. the temperature at which the moisture in the air begins or would begin to collect on surfaces
8. tornado	h. a disturbance of the atmosphere accompanied by wind and usually by rain, snow, hail, sleet, or thunder and lightning
9. typhoon	i. a violent destructive whirling wind accompanied by a funnel-shaped cloud that moves in a narrow path over the land
10. storm	j. a cyclone formed in the tropics with winds of 75 miles (120 kilometers) per hour or greater that is usually accompanied by rain, thunder, and lightning
11. sleet	
12. dust	

Part 3
Weather Modification

Smaller efforts at controlling or modifying the weather, such as the use of smudge pots to prevent orchard frosts, utilize relatively manageable engineering. A major breakthrough in weather modification occurred in 1946, when it was discovered that seeding supercooled clouds with dry ice pellets could produce precipitation. The same effect is produced by seeding with silver iodide smoke. Seeding is based on the artificial provision of nuclei for the condensation or freezing of water vapor in the air. Most seeding is done from aircraft. Other means include airborne ramjets, rocket and artillery shells, and ground-based generators. Cloud seeding is mainly used to increase precipitation in order to fight drought. Some seeding inhibits cloud formation and thus diminishes precipitation. This may be valuable in flood prevention.

Seeding experiments are aimed at dispersing fog at airports, reducing the formation of crop-damaging hailstones, preventing forest fires by suppressing lightning, and reducing the fury of hurricanes. Seeding may also be used to redistribute precipitation and to diminish heavy snowfalls. Because there are large, unexpected natural variations in the weather, it is almost impossible to measure the effectiveness of human intervention. In attempts to increase rainfall, for example, it is difficult to determine how much rain would have fallen without seeding.

By the late 1980s, success in controlling the weather was almost entirely limited to increasing precipitation and dispersing fog. Intentional modification of the weather remains speculative. Research in the 1980s emphasized the numerical modeling of small-scale weather systems and cloud physics. By modeling these systems with sufficient accuracy, researchers were able to determine the kind of action necessary to bring about the desired change in weather.

(adopted from «climate.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out numbers.

Exercise 2. In what context are the numbers from Exercise 1 mentioned?

Exercise 3. Look through the text and define which of the following key-words are mentioned in it.

fog tropical air ground-based generators modeling of small-scale weather systems tornado

Exercise 4. Are the following statements true or false?

1. A major breakthrough in weather modification was connected with the discovery that seeding supercooled clouds with dry ice pellets could produce precipitation.

2. Seeding is based on the artificial provision of nuclei for the heating and evaporating of water in the air.
3. Unfortunately, seeding is not valuable in flood prevention.
4. The purpose of seeding experiments is to disperse fog at airports, to reduce the formation of crop-damaging hailstones, to prevent forest fires by suppressing lightning, and to reduce the fury of hurricanes.
5. It is very easy to measure the effectiveness of human intervention, because there are large, unexpected natural variations in the weather.
6. By the late 1980s, success in controlling the weather went far beyond increasing precipitation and dispersing fog.
7. Research in the 1980s placed great emphasis on the numerical modeling of small-scale weather systems and cloud physics.

Exercise 5. Answer the following questions:

1. What are the means of controlling or modifying the weather?
2. What effect is produced by seeding with silver iodide smoke?
3. What is cloud seeding used for?
4. What are the aims of seeding?
5. Why is it almost impossible to measure the effectiveness of human intervention?
6. Why does the intentional modification of the weather remain speculative?
7. What enables researchers to determine the kind of action necessary to bring about the desired change in weather?

Exercise 6. Match the word with its definition.

1. orchard	a. a gloomy condition of the atmosphere or a substance causing it
2. utilize	b. a little ball
3. precipitation	c. a place where fruit or nut trees are grown
4. fog	d. amount of precipitation
5. vapor	e. an uncontrolled fire in a wooded area
6. rainfall	f. freedom from error
7. intentional	g. to find out or come to a decision
8. accuracy	h. to make use of especially for a certain job
9. determine	i. fine particles of water floating in the air and clouding it
10. pellet	j. done by intention : not accidental voluntary
11. forest fire	
12. lightning	

Unit 3. Climatology

Part 1

Exercise 1. Put the sentences into correct order. Read the whole paragraph.

a. In the timescales of hours to days, meteorology separates into micro-, meso-and synoptic scale meteorology.
b. Other subclassifications are available based on the need by humans, or by the unique, local or broad effects that are studied within that sub-class.
c. At one extreme of this scale is climatology.
d. Respectively, the geospatial size of each of these three scales relates directly with the appropriate timescale.
e. In the study of the atmosphere, meteorology can be divided into distinct areas of emphasis depending on the temporal scope and spatial scope of interest.

Exercise 2. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. Boundary layer meteorology / in the air layer / known as / directly above Earth's surface / is the study of processes / or peplosphere / the atmospheric boundary layer.
2. cause turbulent mixing / The effects of the surface / within the air layer / heating, cooling, and friction.
3. or momentum on time scales / Significant fluxes of heat, matter / are advected by / of less than a day / turbulent motions.
4. Boundary layer meteorology / of surface-atmosphere boundary / including ocean / includes the study of all types / lake, urban land / and non-urban land.

Exercise 3. Fill in the gaps with the words from the box. Read the whole paragraph.

climate	extratropical	meteorology	microscale	synoptic	tropical
troposphere	vertical	weather			

Mesoscale (1) … is the study of atmospheric phenomena that has horizontal scales ranging from (2) … limits to (3) … scale limits and a vertical scale that starts at the Earth's surface and includes the atmospheric boundary layer, (4) …, tropopause, and the lower section of the stratosphere. Mesoscale timescales last from less than a day to the lifetime of the event, which in some cases can be weeks. The events typically of interest are thunderstorms, squall lines, fronts, precipitation bands in (5) … and extratropical cyclones, and topographically generated weather systems such as mountain waves and sea and land breezes.

Synoptic scale meteorology is generally large area dynamics referred to in horizontal coordinates and with respect to time. The phenomena typically described by synoptic meteorology include events like (6) … cyclones, baroclinic troughs and ridges, frontal zones, and to some extent jets. All of these are typically given on (7) … maps for a specific time. The minimum horizontal scale of synoptic phenomena is limited to the spacing between surface observation stations.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word with its definition.

1. temporal	a. one thickness or fold over or under another
2. spatial	b. relating to, typical of, or being a city
3. scale	c. an upper portion of the atmosphere above the troposphere where temperature changes little and clouds rarely form
4. layer	d. relating to time as opposed to eternity
5. turbulent	e. a long and narrow or shallow hollow
6. urban	f. relating to space
7. boundary	g. a storm or system of winds that rotates about a center of low atmospheric pressure counterclockwise in the northern hemisphere, advances at a speed of 20 to 30 miles (30 to 50 kilometers) an hour, and often brings a great deal of rain
8. troposphere	h. something that points out or shows a limit or end : dividing line
9. stratosphere	i. causing or being in a state of unrest, violence, or disturbance
10. cyclone	j. the portion of the atmosphere which extends from the earth's surface to the bottom of the stratosphere and in which temperature generally decreases rapidly with altitude
11. trough	
12. ridge	

(adopted from «climatology.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

In contrast to meteorology, which studies short term weather systems lasting up to a few weeks, climatology studies the frequency and trends of those systems. It studies the periodicity of weather events over years to millennia, as well as changes in long-term average weather patterns, in relation to atmospheric conditions. Climatologists, those who practice climatology, study both the nature of climates - local, regional or global - and the natural or human-induced factors that cause climates to change. Climatology considers the past and can help predict future climate change.

Climatology is approached in a variety of ways. Paleoclimatology seeks to reconstruct past climates by examining records such as ice cores and tree rings (dendroclimatology). Paleotempestology uses these same records to help determine hurricane frequency over millennia. The study of contemporary climates incorporates meteorological data accumulated over many years, such as records of rainfall, temperature and atmospheric composition. Knowledge of the atmosphere and its dynamics is also embodied in models, either statistical or mathematical, which help by integrating different observations and testing how they fit together.

Modeling is used for understanding past, present and potential future climates. Historical climatology is the study of climate as related to human history and thus focuses only on the last few thousand years.

Climate research is made difficult by the large scale, long time periods, and complex processes which govern climate. Climate is governed by physical laws that can be expressed as differential equations. These equations are coupled and nonlinear, so that approximate solutions are obtained by using numerical methods to create global climate models. Climate is sometimes modeled as a stochastic process but this is generally accepted as an approximation to processes that are otherwise too complicated to analyze.

(adopted from «climatology.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

meteorology	climate	hurricane	climatology	equation

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Meteorology studies short term weather systems lasting up to a few weeks.
2. Climatology can't help predict future climate change.
3. Paleoclimatology seeks to reconstruct past climates by examining records.
4. Paleotempestology uses records to help determine rainfall frequency over millennia.
5. Historical climatology is the study of climate as related to human history.
6. Climate is governed by mathematical laws that can be expressed as differential equations.
7. Climate is sometimes modeled as a stochastic process.

Exercise 4. Answer the following questions:

1. What does meteorology study?
2. What do climatologists study?
3. What causes climate to change?
4. Which sciences does climatology consist of?
5. What is modeling used for?
6. Which laws is climate governed by?
7. What does historical climatology study?

Exercise 5. Match the words with their definitions.

1.	meteorology	a.	a cyclone formed in the tropics with winds of 74 miles (119 kilometers) per hour or greater that is usually accompanied by rain, thunder, and lightning
2.	average	b.	a period of 1000 years
3.	atmospheric	c.	an act of gathering information (as for scientific studies) by noting facts or occurrences
4.	climate	d.	d) a science that deals with the atmosphere, weather, and weather forcasting
5.	hurricane	e.	the average weather conditions of a particular place or region over a period of years
6.	millennia	f.	capable of becoming real
7.	rainfall	g.	relating to the atmosphere
8.	observation	h.	equaling or close to an arithmetic mean
9.	equation	i.	careful study and investigation for the purpose of discovering and explaining new knowledge
10.	stochastic	j.	a statement of the equality of two mathematical expressions
11.	research		
12.	potential		

Part 3

The level is used for determining height differences and height reference systems, commonly referred to mean sea level. The traditional spirit level produces these practically most useful heights above sea level directly; the more economical use of GPS (Global Positioning System) instruments for height determination requires precise knowledge of the figure of the geoid, as GPS only gives heights above the GRS80 reference ellipsoid. As geoid knowledge accumulates, one may expect use of GPS heighting to spread.

The theodolite is used to measure horizontal and vertical angles to target points. These angles are referred to the local vertical. The tacheometer additionally determines, electronically or electro-optically, the distance to target, and is highly automated to even robotic in its operations. The method of free station position is widely used. For local detail surveys, tacheometers are commonly employed although the old-fashioned rectangular technique using angle prism and steel tape is still an inexpensive alternative. Real-time kinematic (RTK) GPS techniques are used as well. Data collected are tagged and recorded digitally for entry into a Geographic Information System (GIS) database.

Geodetic GPS receivers produce directly three-dimensional coordinates in a geocentric coordinate frame. Such a frame is, e.g., WGS84, or the frames that are regularly produced and published by the International Earth Rotation and Reference Systems Service (IERS). GPS receivers have almost completely replaced terrestrial instruments for large-scale base network surveys. For Planet-wide geodetic surveys, previously impossible, we can still mention Satellite Laser Ranging (SLR) and Lunar Laser Ranging (LLR) and Very Long Baseline Interferometry (VLBI) techniques. All these techniques also serve to monitor Earth rotation irregularities as well as plate tectonic motions.

(adopted from «cimatology.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text.

level survey tacheometer frame target

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The level is used for determining length differences and height reference systems.
2. The more economical use of GPS instruments for height determination requires precise knowledge of the figure of the geoid.
3. The theodolite is used to measure horizontal and vertical angles.
4. The method of free station position is widely used.
5. Real-time kinematic (RTK) GPS techniques are not widely used.
6. Geodetic GPS receivers produce directly two-dimensional coordinates in a geocentric coordinate frame.
7. GPS receivers have almost completely replaced terrestrial instruments.

Exercise 4. Answer the following questions:

1. What is level used for?
2. What does the traditional spirit level produce?
3. Which angles does the theodolite measure?
4. Which method is widely used?
5. What happens to collected data?
6. Which coordinates do geodetic GPS receivers produce?
7. Which receivers have almost completely replaced terrestrial instruments?

Exercise 5. Match the words with their definitions.

1. sea level	a. a measure of the amount that one line of an angle would have to be turned to be in exactly the same place as the other line
2. determination	b. relating to the earth or its living things
3. geoid	c. the height of the surface of the sea midway between the average high and low tides
4. angle	d. the act of rotating especially on an axis
5. rectangular	e. a settling or making sure of the position, size, or nature of something
6. data	f. to put back in a proper or former place
7. coordinate	g. facts about something that can be used in calculating, reasoning, or planning
8. frame	h. having edges, faces, or surfaces that meet at right angles
9. replace	i. relating to tectonics
10 terrestrial	j. any of a set of numbers used to locate a point on a line or surface or in space
11. rotation	
12. tectonic	

Unit 4. Weather Forecasting

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. This made possible the rapid collection and dissemination of weather observations.
b. Accurate measurements of temperature and atmospheric pressure—the basic elements of weather—were not available until after the thermometer and the barometer were perfected in the 17th century.
c. Through the ages, do-it-yourself weather forecasts were based on local observations made directly by the human senses.
d. Comprehensive weather forecasting did not become practical until the telegraph was invented in the 19th century.

Exercise 2. Fill in the gaps with the words from the box. Read the whole paragraph.

come	date	weather	person	scientist	maps	daily
telegraphic	new					

The first systematic (1)… observations in the United States (2)… back to 1738. In 1816 the German (3)… Heinrich Brandes drew one of the world's first known weather (4)…. In 1849 Joseph Henry of the Smithsonian Institution in Washington, D.C., established a (5)… network of observations for the preparation of (6)… weather maps.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. Government weather forecasts / in the United States / by the Army Signal Service / were first issued / in 1870.
2. were transferred / In 1891 / the Army's civilian weather activities / under the United States Weather Bureau / to the Department of Agriculture.
3. to the Department of Commerce / was moved / and was made part of / The Weather Bureau / the Environmental Science Services Administration / in 1965 / in 1940.
4. and was renamed / In 1970 / the Weather Bureau / became part of / the National Weather Service / the National Oceanic and Atmospheric Administration (NOAA).
5. in Canada / are directed by / Civilian weather activities / , an agency of the Department of the Environment / the Atmospheric Environment Service.
6. an agency of the United Nations / dates from 1951 / The World Meteorological Organization (WMO).
7. the worldwide exchange / The WMO / of weather and climate information / coordinates.
8. established in 1873 / grew out of / it / the International Meteorological Organization.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. forecast	a. occurring, done, produced, or used every day or every weekday
2. perfect	b. an estimate or prediction of a future happening or condition
3. rapid	c. a drawing or picture showing selected features of an area (as the surface of the earth or the moon or a section of the brain) and usually drawn to a given scale
4. map	d. a major administrative division of a government or business
5. network	e. to request or instruct with authority
6. daily	f. very fast
7. civilian	g. to make perfect; to bring to final form
8. department	h. not on active duty in the armed services or not on a police or firefighting force
9. exchange	i. a group or system of related or connected parts
10. direct	j. a giving or taking of one thing in return for another
11. grow out	
12. agency	

(adopted from «weather.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2
Methods of Weather Forecasting

One of the most common methods of weather forecasting today is synoptic forecasting. It is based on a summary, or synopsis, of the total weather picture at a given time. The development and movement of weather systems is shown on a sequence of synoptic charts, or weather maps. These weather systems are then projected into the future. The weather observations used for synoptic charts are made at thousands of weather stations around the world four times a day—at midnight, 6 AM, noon, and 6 PM, Greenwich mean time (GMT).

Another method, statistical forecasting, employs mathematical equations based on examination of the past behavior of the atmosphere. Still another, numerical forecasting, uses mathematical models based on the physical laws that describe atmospheric behavior. For forecasts of up to about five days, numerical methods are most often used; for somewhat longer periods, statistical methods are more accurate. Beyond about 90 days, weather events can be predicted just as well through climatological forecasting, or by using the averages of past weather records.

In weather analyses, isobars are drawn on a map. These are lines connecting points of equal atmospheric pressure. Charts showing the height of constant-pressure (isobaric) surfaces and other sets of isolines aloft also are drawn. This was a major timeconsuming task when it was done manually. Analysis is now largely done automatically on computers as part of numerical prediction. The computer-drawn maps show all isolines and centers of maximum and minimum value. The maps are issued as paper copy for further study and manual modification, as microfilm for archiving and retrieval, or as signals that go out over the facsimile networks to all receiving stations for continuous mapping.

Numerical weather prediction is essentially a problem in fluid dynamics. Complete and precise data on the initial state of the Earth's atmosphere, water bodies, and land surfaces, plus a complete understanding of the physical laws describing the transfer of heat and moisture, theoretically could yield near-perfect numerical weather forecasts. Such information, however, is not fully available.

(adopted from «weather.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text. What do they refer to?

weather prediction	receiving stations	manual modification
averages of past weather records	synoptic forecasting	

Exercise 2. Look through the text and copy out methods of weather forecasting. What are the differences between them?

Exercise 3. Are the following statements true or false?

1. Synoptic forecasting is based on analyses of weather maps.
2. Weather observations are made once every day.
3. Mathematical models and equations help in weather forecasting.
4. Computers are not widely used in weather forecasting – many things are done manually.
5. Statistical forecasting is the most accurate method of weather forecasting.
6. Complete and precise information is available.

Exercise 4. Answer the following questions:

1. What are the main methods of weather forecasting?
2. What is the role of synoptic charts?
3. Where are the weather observations made?
4. When are numerical methods of forecasting used?
5. When are statistical methods of forecasting used?
6. What so isolines show?
7. Is knowledge of physical laws important for weather forecasting? Why or why not?

Exercise 5. Match the words with their definitions.

1. synopsis	a. in the air
2. chart	b. a statement of the equality of two mathematical expressions
3. project	c. a line drawn on a map to indicate areas having the same atmospheric pressure at a given time or for a given period
4. mean	d. an outline map showing something (as differences in climate or magnetism) according to geography
5. employ	e. a brief statement or outline
6. equation	f. an act or process of retrieving
7. average	g. to plan, figure, or estimate for the future
8. isobar	h. to make use of
9. aloft	i. to take or get something that is given, paid, or sent
10. manually	j. a level typical of a group, class, or series
11. retrieval	
12. recieve	

Part 3

Collection and Distribution of Weather Data

Weather stations in the United States transmit coded weather data every hour for aviation use, every six hours for general forecasting, and daily for climatological records. Surface weather data are included on precipitation, temperature, atmospheric pressure, change in pressure, wind direction and speed, humidity, dew point, cloud type, sky cover, visibility, ceiling, and current weather. In addition, daily measurements of temperature extremes and precipitation are made by volunteer observers at thousands of substations. Other weather networks are operated for warning of floods, fire weather, fruit frost, and tornadoes; for reporting weather conditions on the Great Lakes (in cooperation with Canada); and for furthering agricultural programs.

National Aeronautics and Space Administration - NASA's Nimbus III satellite, launched in 1969, was equipped with a remote sensor called the satellite infrared spectrometer (SIRS). From the SIRS measurement of infrared radiation, vertical temperature soundings could be calculated over large areas. A high-resolution infrared radiometer (HRIR) on Nimbus III was used to distinguish between warm and cold ocean currents, clouds and snow, and ice and water. In cloud-free areas the location and extent of ice fields and snow cover could be determined. This was useful in predicting floods and also for calculating thermal radiation in numerical weather forecasting.

One of the best devices for continuous detection and tracking of hurricanes, thunderstorms, tornadoes, and other severe storms at distances up to 250 miles is radar. At Kansas City, Mo., radar summaries of the weather over the country are prepared and distributed by facsimile networks. The new radar capability of the United States Weather Service is the Weather Surveillance Radar-1988 Doppler (WSR-88D, or NEXRAD) which, when completed, will employ 137 radar stations to identify low-level wind shears associated with tornadoes.

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Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text. What do they refer to?

calculate temperature and radiation	weather data	radar capability
tornado	dew point	

Exercise 2. Look through the text and copy out proper names. What do they refer to?

Exercise 3. Are the following statements true or false?

1. There is a wide network of weather stations in the United States.
2. They transmit general forecasting every hour.
3. NASA's Nimbus III satellite is the most modern device.
4. It is equipped with infrared spectrometer and radiometer.
5. The satellite was used for statistical weather forecasting.
6. Hurricanes and thunderstorms can also be detected and tracked.
7. Remote sensors are employed for this work.

Exercise 4. Answer the following questions:

1. How often is coded weather data transmitted in the United States? What for?
2. What measurements are made?
3. Can floods and tornadoes be predicted?
4. How does NASA's Nimbus III satellite work?
5. What does it help to forecast?
6. What other devices for weather forecasting are used?
7. What is the capability of the new radar?

Exercise 5. Match the words with their definitions.

1. transmit	a. a man-made object or vehicle intended to orbit the earth, the moon, or another heavenly body
2. precipitation	b. inflicting pain, distress, or hardship
3. humidity	c. to send a signal by radio waves or over a wire
4. flood	d. to know or point out the difference
5. satellite	e. a great flow of water that rises and spreads over the land
6. launch	f. water or the amount of water that falls to the earth as hail, mist, rain, sleet, or snow
7. resolution	g. to send off an object especially with force
8. distinguish	h. discovering the nature, existence, presence, or fact of
9. severe	i. the range, distance, or space over or through which something extends
10. extent	j. the amount of moisture in the air
11. detection	
12. tracking	

Unit 5. Landscape Ecology

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a) He developed this terminology and many early concepts of landscape ecology as part of his early work applying aerial photograph interpretation to studies of interactions between environment and vegetation.
b) They are the distribution and flow of energy, materials and individuals in the environment.
c) Landscape ecology is a sub-discipline of ecology and geography that address how spatial variation in the landscape affects ecological processes.
d) Landscape ecology typically deals with problems in an applied and holistic context.
e) The term landscape ecology was coined by Carl Troll, a German geographer in 1939.

Exercise 2. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. and incorporate quantitative methods / Developments in landscape ecology / between spatial patterns / illustrate the important relationships / and ecological processes.
2. at broad spatial and temporal scales / and ecological processes / They link spatial patterns.
3. to solve environmental problems / This linkage of time / can assist land managers / space, and environmental change / in applying land management plans.
4. has highlighted / The increased attention / on spatial dynamics / the need for new quantitative methods / in recent years.

5. They can analyze patterns / and develop reliable landscape models / on the landscape / determine the importance / of spatially explicit processes.

Exercise 3. Fill in the gaps with the words from the box. Read the whole paragraph.

analysis(2)	determine	habitat	number
statistics	techniques	used	vegetation

Multivariate (1) … techniques, a type of statistics incorporating many variables, are frequently (2) … to examine landscape level vegetation patterns. A (3) … of studies in riparian systems and wetlands use a variety of statistical (4) …, such as cluster analysis, canonical correspondence analysis (CCA), or detrended correspondence (5) … (DCA), for classifying (6) … . Gradient analysis is another way to (7) … the vegetation structure across a landscape, or to help delineate critical wetland habitat for conservation or mitigation purposes.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. affect	a. relating to or concerned with wholes or with complete systems rather than with the individual parts
2. distribution	b. fit to be trusted
3. environment	c. plant life or cover
4. holistic	d. situated near the coast
5. vegetation	e. land or areas (as marshes or swamps) having much soil moisture — usually used in plural
6. interaction	f. the natural geographic range of a living thing
7. spatial	g. the whole complex of factors (as soil, climate, and living things) that influence the form and the ability to survive of a plant or animal or ecological community
8. reliable	h. a number of similar things growing, collected, or grouped together
9. riparian	i. the action or influence of people, groups, or things on one another
10. wetland	j. to produce a significant influence upon or change in
11. cluster	
12. mitigation	

(adopted from «landscape ecology.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Landscape ecology, as a theory, stresses the role of human impacts on landscape structures and functions and proposes ways for restoring degraded landscapes. Landscape ecology explicitly includes humans as entities that cause functional changes on the landscape. Landscape ecology theory includes the landscape stability principle, which emphasizes the importance of landscape structural heterogeneity in developing resistance to disturbances, recovery from disturbances, and promoting total system stability.

This principle is a major contribution to general ecological theories which highlight the importance of relationships among the various components of the landscape. Integrity of landscape components helps maintain resistance to external threats, including development and land transformation by human activity. Analysis of land use changes has included a strongly geographical approach within landscape ecology. This has led to acceptance of the idea of multifunctional properties of landscapes. There are still calls for a more unified theory of landscape ecology due to differences in professional opinion among landscape ecologists, and the interdisciplinary approach to the discipline.

An important related theory is hierarchy theory, which refers to how systems of discrete functional elements operate when linked at two or more scales. For example, a forested landscape might be hierarchically composed of drainage basins, which in turn are composed of local ecosystems or stands, which are in turn composed of individual trees and tree gaps. Recent theoretical developments in landscape ecology have emphasized the relationship between pattern and process, as well as the effect that changes in spatial scale has on the potential to extrapolate information across scales. Several studies suggest that the landscape has critical thresholds at which ecological processes will show dramatic changes, such as the complete transformation of a landscape by an invasive species with a small change in average temperatures per year which favors the invasive habitat requirements.

(adopted from «landscape ecology.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text. What do they refer to?

landscape	component	ecology	theory	temperature

Exercise 2. Look through the text and give the title to it.

Exercise 3. Are the following statements true or false?

1. Landscape ecology, as a theory, stresses the role of natural impacts on landscape structures.
2. Landscape ecology theory includes the landscape stability principle.

3. Integrity of landscape components helps maintain resistance to internal threats.
4. Analysis of land use changes has included a strongly geographical approach within landscape ecology.
5. Hierarchy theory refers to how systems of discrete functional elements operate.
6. A forested landscape might be hierarchically composed of drainage basins.
7. Local ecosystems or stands are composed of forests and fields.

Exercise 4. Answer the following questions:
1. What does landscape ecology stress?
2. Are land use changes studied by landcape ecology?
3. What does hierarchy theory refer to?
4. Is the relationship between pattern and process a part of study?
5. When will ecological processes show dramatic changes?
6. What kind of changes?
7. What does the complete transformation of a landcape lead to?

Exercise 5. Match the words with their definitions.

1. landscape	a. the act of disturbing
2. impact	b. a large or small hollow area in the surface of the land or in the ocean floor
3. disturbance	c. way of dealing with something
4. highlight	d. a picture of natural scenery
5. external	e. an arrangement into a series according to rank
6. acceptance	f. arising or acting from outside
7. approach	g. a forceful effect
8. hierarchy	h. a category of living things that ranks below a genus, is made up of related individuals able to produce fertile offspring, and is identified by a two-part scientific name
9. discrete	i. to center attention on
10. basin	j. the place or type of place where a plant or animal naturally or normally lives or grows
11. habitat	
12. species	

Part 3

Point positioning is the determination of the coordinates of a point on land, at sea, or in space with respect to a coordinate system. Point position is solved

by computation from measurements linking the known positions of terrestrial or extraterrestrial points with the unknown terrestrial position. This may involve transformations between or among astronomical and terrestrial coordinate systems. The known points used for point positioning can be triangulation points of a higher order network, or GPS(Global Positioning System) satellites.

Traditionally, a hierarchy of networks has been built to allow point positioning within a country. Highest in the hierarchy were triangulation networks. These were densified into networks of traverses (polygons), into which local mapping surveying measurements, usually with measuring tape, corner prism and the familiar red and white poles, are tied. Nowadays all but special measurements (e.g., underground or high precision engineering measurements) are performed with GPS. The higher order networks are measured with static GPS, using differential measurement to determine vectors between terrestrial points. These vectors are then adjusted in traditional network fashion. A global polyhedron of permanently operating GPS stations under the auspices of the IERS is used to define a single global, geocentric reference frame which serves as the «zero order» global reference to which national measurements are attached.

For surveying mappings, frequently Real Time Kinematic GPS is employed, tying in the unknown points with known terrestrial points close by in real time. One purpose of point positioning is the provision of known points for mapping measurements, also known as (horizontal and vertical) control. In every country, thousands of such known points exist and are normally documented by the national mapping agencies. Surveyors involved in real estate and insurance will use these to tie their local measurements to.

(adopted from «landscape ecology.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text. What do they refer to?

position pole GPS measurement horizontal

Exercise 2. Look through the text and give the title to it.

Exercise 3. Are the following statements true or false?
1. Point positioning is the determination of the coordinates of a point only on land.
2. Point positioning is the determination of the coordinates with respect to a coordinate system.
3. The known points can be triangulation points of GPS satellites.
4. Lowest in the hierarchy were triangulation networks.
5. Nowadays all but special measurements are performed with GPS.
6. For surveying mappings, frequently Real Time Static GPS is employed.
7. The provision of known points for mapping measurements is one purpose of point positioning.

Exercise 4. Answer the following questions:

1. What is point positioning?
2. Which measurements help to solve point position?
3. What are the known points used for point positioning?
4. Which networks were highest in the triangulation?
5. What performs special measurements?
6. What is employed for surveying mappings?
7. What is the purpose of point positioning?

Exercise 5. Match the words with their definitions.

1. positioning	a. putting in a certain position
2. computation	b. the act or process of measuring
3. extraterrestrial	c. a quantity that has magnitude and direction and that is usually represented by a line segment with the given direction and with a length representing the magnitude
4. transformation	d. coming from or existing outside the earth or its atmosphere
5. network	e. to make distinct, clear, or detailed especially in outline
6. mapping	f. predicting the future especially according to the flight of birds
7. measurement	g. the act or action of computing
8. static	h. measured from the earth's center
9. define	i. relating to bodies at rest or forces that are balanced
10. auspice	j. an act, process, or example of transforming or being transformed
11. geocentric	
12. vector	

Unit 6. Geography: Settlements and Interactions

Part 1

Exercise 1. Fill in the gaps with the words from the box.

Studying the location and arrangement of physical and human elements is only a part of the science of (1)… . Having established the patterns of different things, geography next calls for an «explanation» of these patterns. This does not mean giving the causes and effects of the arrangement. It simply means

seeing how two or more things are associated in an (2)… and whether a particular thing occurs in a given area only if another element is also present. For example, in studying the Earth's surface, (3)… find that the productive (4)… lands of the world occur where the growing (5)… is long and (6)…, the soils fertile, and the landforms relatively (7)… .

Exercise 2. Put the words and phrases of the given sentences into the proper order.

1. may also be / Other areal / pointed out/associations / .
2. the character / of an area / The climate / related to / of the soils / for instance, is closely /.
3. the differences / animal life /This largely / in plant and / surface / explains / over the Earth's /.
4. and rainfall / other than / Temperature / are also related to / farming /activities / .

Exercise 3. Put the sentences into the proper order and read the whole paragraph.

a. The amount of insolation received at any given place is «explained» by the angle of the sun's rays and the length of the day.
b. On the other hand, December at this latitude is a winter month.
c. For example, at latitude 40° North, June days are almost 15 hours long, and the sun at noon is relatively high in the sky.
d. One of the basic associations is that of latitude and the amount of heat, or insolation, received from the sun.
e. The amount of heat received is great, and the days are warm.
f. The days are only about nine hours long, and the noon sun is low.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word and its definition.

1. particular	a. to direct someone's attention to
2. surface	b. of or relating to a single person or thing
3. productive	c. amount of precipitation
4. fertile	d. distance north or south from the equator measured in degrees
5. smooth	e. the outside of an object or body
6. point out	f. having a continuous even surface
7. climate	g. solar radiation that has been received (as by the earth)
8. rainfall	h. producing vegetation or crops plentifully

9. latitude	i. the degree of hotness or coldness of something (as air, water, or the body) as shown by a thermometer
10. insolation	j. the average weather conditions of a particular place or region over a period of years
11. temperature	
12. amount	

(adopted from « geography.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

The Arrangement of Settlements

In order to carry on their different activities, people have established themselves in various ways on the Earth's surface. Some live in temporary settlements and travel about. Most people, however, live in more permanent settlements.

Rural settlements are those that are related to farming, lumbering, mining, fishing, and hunting. In some places people engaged in these activities live separately from one another. For instance, in some parts of the world farmers live on farmsteads located on the land they work. We say that their homes are dispersed, or scattered. These dispersed settlements may be arranged in an orderly fashion, following a system of land survey, or they may be irregularly arranged over the land.

In other areas farmers, fishermen, miners, and lumbermen live together in villages. Settlements of this nature are called agglomerated settlements. They are still rural, however. Their shapes vary from a line type of rural settlement to a compact circle or rectangle.

Other types of settlements have been developed by people engaged in manufacturing and trade. These urban settlements range in size from small villages to large metropolitan areas. An urban settlement is one where most people carry on their work to serve those outside the community. It has sections where shopping is done; areas where products are manufactured; and sections where people live and play. Geography is concerned with the character and patterns of both rural and urban settlements.

(adopted from « geography.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it and put them in the order they appear.

metropolitan area	community	means of transport
rural settlement	the flow of goods	

Exercise 2. Look through the text and copy out the names of occupations connected with different kinds of settlements.

Exercise 3. Are the following statements true or false?

1. Rural settlements are never related to farming, lumbering, mining, fishing, and hunting.
2. Dispersed settlements may be arranged either in an orderly or irregularly fashion.
3. In some parts of the world farmers live on farmsteads located on the land they work.
4. Villages are urban settlements.
5. There are line, circle or rectangle shapes of villages.
6. Urban settlements range in size from small villages to large metropolitan areas.
7. Geography studies only urban settlements.

Exercise 4. Answer the following questions:

1. How do most people live?
2. What types of settlements do you know?
3. What are rural settlements?
4. How could dispersed settlements be arranged?
5. What is an agglomerated settlement?
6. Do the urban settlements range in size?
7. What sections may an urban settlement consist of?

Exercise 5. Match the word and its definition.

1. irregular	a. to make from raw materials by hand or by machinery
2. manufacture	b. having independent existence
3. surface	c. lasting or intended to last for a very long time
4. temporary	d. of or relating to the country, country people or life, or agriculture
5. permanent	e. to be the business or affair of
6. lumberman	f. the buildings and nearby service areas of a farm
7. farmstead	g. not following custom or rule
8. separate	h. of, relating to, typical of, or being a city
9. rural	i. to continue especially in spite of difficulties
10. urban	j. lasting for a limited time
11. carry on	
12. be concerned with	

Part 3

A third part of the study of geography pertains to the study of the interrelations of one area with another. It deals with the flow of goods and of people among areas. This phase of geography is also called spatial interaction.

Studies in geography have covered the economic and political interactions between one part of the world and another. Until a few centuries ago areas of the world were almost cut off one from another due to the difficulties of transportation. Each part produced nearly everything it consumed. Improved means of transport since the Industrial Revolution have made possible cheap, speedy, and large-scale exchange of goods. All parts of the world have now been brought into close economic relationships. Trade has been greatly accelerated and extended. Today many things Americans use are imported from other parts of the Earth.

In recent years there have also been increasing interactions of a political nature among nations. In the 20th century there have been two world wars and a number of lesser skirmishes among the major world powers. These conflicts have come about because nations have not yet learned to live with one another without fear. The search for security or the drive for expansion has given rise to a continual struggle for power.

Several formulas for reducing conflicts have been advanced. These include alliances between two countries and alliances among most of the countries of the world, such as the United Nations. Alliances commonly result in the flow of power—men or weapons—from one country to another. Geography is concerned with the pattern of this flow.

(adopted from «geography.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. What do they refer to?

types of settlements   alliances   spatial interaction   speedy   farmstead

Exercise 2. Look through the text and give the title to it.

Exercise 3. Are the following statements true or false?

1. Spatial interaction is a phase of geography that deals with the flow of goods and of people among areas.
2. A few years ago areas of the world were almost cut off one from another due to the difficulties of transportation.
3. Trade has been greatly accelerated and extended since Industrial Revolution.
4. Today Americans use things that are made only in their country.
5. In the 20th century there were three world wars.
6. The United Nations is the alliance between two countries.
7. Alliances commonly result in the flow of power between countries.

Exercise 4. Answer the following questions:

1. What science deals with the economic and political interactions between one part of the world and another?
2. Why were areas of the world almost cut off one from another a few centuries ago?
3. What made cheap, speedy, and large-scale exchange of goods possible?
4. What type of interactions among nations has been increasing in recent years?
5. When were all parts of the world first brought into close economic relationships?
6. What has given rise to a continual struggle for power?
7. What are the ways of reducing conflicts?

Exercise 5. Match the word with its definition.

1. weapon	a. a state of affairs existing between those having shared dealings
2. due to	b. a union between nations for assistance and protection
3. consume	c. of or relating to a time not long past
4. exchange	d. something with which one fights or struggles against another
5. relationship	e. a minor fight between small bodies of troops
6. import	f. to use as a customer
7. recent	g. a giving or taking of one thing in return for another
8. skirmish	h. to bring (as goods) into a country from another country usually for selling
9. expansion	i. because of
10. reduce	j. to make smaller in size, amount, or number
11. alliance	
12. continual	

Unit 7. Oceanography

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. Increased use of ocean resources has fostered new branches that deal with public policy, archaeology, conservation, and many environmental concerns.

b. There are many opportunities for employment in the general field of oceanography through research organizations and industrial firms that have interests in the ocean.
c. The field of oceanography is traditionally divided into four major areas of research: physical, chemical, biological, and geological.
d. A research oceanographer usually has a bachelor's degree with studies in the basic sciences of physics, chemistry, and biology and often with specialized postgraduate training.

Exercise 2. Fill in the gaps with the words from the box. Read the whole paragraph.

Form	geological	describe	biological	distribution
marine	chemical	structural	geography	

Physical oceanographers (1)… the physical state of the sea, particularly (2)… of water masses, the conditions that (3)… them, and the great currents that disperse and mix them. (4)… oceanographers study the chemical constituents of seawater and their consequences on biological, geological, and physical processes in the (5)… environment. (6)… oceanographers study the plant and animal life of the sea. (7)… oceanographers are concerned with the geological structure and mineral content of the ocean floor as well as with phenomena ranging in scale from the planetary to that of individual sediment particles.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. Increased opportunities / such as / have created / needs for public policies,/ and uses of the ocean / an international law of the sea.
2. Marine archaeologists / seacoast habitats / study / often attempting to reconstruct / of the past / submerged artifacts.
3. are notable achievements / Studies of the wreck / one of the richest / of the Nuestra Señora de Atocha off Key West, Fla.,/ and most profitable / and the site of the Titanic / archaeological treasure finds of all time.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. foster	a. to cause to become spread widely; to move in different directions
2. branch	b. water in or from the sea
3. deal with	c. the material from a liquid that settles to the bottom; material (as stones and sand) deposited by water, wind, or glaciers
4. research	d. to take action
5. postgraduate	e. relating to, or engaged in formal studies after graduation
6. ocean	f. to give parental care to; to help the growth or development of
7. disperse	g. deserving special notice
8. constituent	h. careful study and investigation for the purpose of discovering and explaining new knowledge ; the collecting of information about a subject
9. seawater	i. the whole body of salt water that covers nearly three fourths of the surface of the earth
10. sediment	j. a separate or subordinate division or part of a central system
11. scale	
12. notable	

(Adopted from «oceanography.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Oceanography: the Oceans

The Earth is the only one of the nine planets in the solar system that is known to have an appreciable amount of water on its surface. More than 98 percent of the water on Earth is in the oceans, and most of the remainder is in glaciers.

Oceanography is the scientific study of all aspects of the oceans, their boundaries, and their contents. Phases of this study include the physical nature of the oceans, their chemical and mineral constituents, the great variety of plant and animal life that inhabits the oceans, and the geological structure of the ocean floor. Oceanography is also concerned with the technical and economic potentials of the oceans.

The oceans function as a very large sump—all the sediments and wastes of the continents pour into them. Some of the elements contained in ocean water have been turned to the use of men. Sodium chloride, or common table salt, is frequently obtained from the oceans, as is magnesium, a lightweight metal. Progress has also been made in the development of desalinization techniques for the conversion of ocean water to fresh water.

Another source of minerals is the ocean floor. Phosphorite deposits, consisting mainly of calcium phosphate, cover parts of the ocean bottom. Diamonds, gold, tin, iron, and sulfur are mined from shallow-water deposits and beaches. Petroleum and natural gas are extracted from the continental shelf.

Manganese nodules cover much of the ocean basins. Formed by chemical precipitation around a nucleus such as a shark's tooth or a piece of volcanic ash, they consist primarily of alternating layers of manganese and iron oxides. Manganese, iron, copper, nickel, and cobalt are also present in high but varying concentrations.

(Adopted from «oceanography.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text. What do they refer to?

Source of minerals	scientific study	table salt	desalinization
fresh water	ocean bottom		

Exercise 2. Look through the text and copy out the names of minerals. What do they refer to?

Exercise 3. Are the following statements true or false?

1. Oceanography deals with different aspects as well as economic potential of the oceans.
2. All the sediments and wastes of the oceans can be useful.
3. Natural gas can be extracted from the continental shelf.
4. Concentrations of different minerals in the oceans vary.
5. Sulfur can not be mined from shallow-water deposits.
6. Manganese nodules are formed due to the process of oxidation.
7. Some valuable minerals cover the ocean basins.

Exercise 4. Answer the following questions:

1. Is there lack of water on the Earth?
2. What percent of the water on the Earth is in glaciers?
3. What does oceanography study?
4. Why do the oceans function as a sump?
5. What is sodium chloride?
6. How are manganese nodules formed?
7. What do phosphorite deposits consist of?

Exercise 5. Match the words with their definitions.

1. solar	a. the solid that remains after material is thoroughly burned or is oxidized by chemical means; fine particles of mineral matter from a volcanic vent
2. amount	b. a remaining group or part

3. remainder	c. a nonmetallic element that occurs either free or combined especially in sulfides and sulfates, is found in proteins, exists in several forms including yellow crystals, and is used especially in the chemical and paper industries, in strengthening rubber, and in medicine for treating skin diseases see element table
4. boundary	d. having little depth
5. content	e. something that points out or shows a limit or end : dividing line
6. concern	f. of, derived from, relating to, or caused by the sun
7. obtain	g. the total number or quantity; a given or particular quantity or number
8. sulfur	h. something contained
9. precipitation	i. to gain or acquire usually by planning or effort
10. ash	j. to relate to : be about
11. shallow	
12. vary	

Part 3
Ocean Floor Exploitation

Early attempts to establish a law of the sea resulted in several United Nations conferences on the law of the sea (UNCLOS). At UNCLOS I, held in Geneva, Switzerland, in 1958, delegates from 86 nations ratified four agreements concerning the continental shelf, the high seas, the territorial sea and adjacent zone, and fishing and conservation of the living resources of the high seas.

Some of the issues addressed in the agreements involved the definition of territories such as the continental shelf. Many delineation rules were challenged. Of the 300 potential territorial-sea or continental-shelf boundaries, less than 25 percent of the boundaries were negotiated by the late 1980s. The rest were in dispute, in some stage of negotiation, or not being discussed. The majority of the boundaries divide the continental shelf of adjacent countries.

The United States was the first country to bring natural resources of the continental shelf under national jurisdiction and control. Many international lawyers contend, however, that such jurisdiction does not include the power to restrict navigation, fishing, or scientific inquiry. The deep-sea bed lies beyond the continental shelf. This vast region cannot be claimed by any nation and its legal status remains uncertain.

After the third law of the sea conference, an agreement was adopted in 1982 to protect the territorial sea rights of Third World countries. The United States, the Soviet Union, and several other countries did not accept the provisions. Until a compromise is reached, unilateral mining laws are implemented by the United States, Germany, and Japan.

(Adopted from «oceanography.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in the text. Put them in the order they appear in the text. What do they refer to?

sea rights   early attempts   ratified four agreements   accept the provisions   compromise   continental shelf

Exercise 2. Look through the text and copy out numerals and names. What do they refer to?

Exercise 3. Are the following statements true or false?

1. The first UN conference on the law of the sea was not successful.
2. It was held in one of the European capitals.
3. The continental shelf was defined in the agreements.
4. Continental-shelf boundaries were negotiated.
5. The deep-sea bed cannot be claimed by any nation.
6. Some agreements were adopted in the late 1990s.
7. All countries accepted the agreement provisions.

Exercise 4. Answer the following questions:

1. What happened in 1958?
2. What do the agreements concern?
3. Which country brought natural resources of the continental shelf under national jurisdiction and control?
4. What was the disadvantage of this?
5. Why can no nation claim the continental shelf?
6. What was the aim of the agreement adopted in 1982?
7. Which countries were concerned?

Exercise 5. Match the words with their definitions.

1. law	a. lying next or near : having a border or point in common
2. result	b. to keep within bounds; to place under limits as to use limit
3. ratify	c. the act or practice of navigating; the science of getting ships, aircraft, or spacecraft from place to place ; esp: the method of figuring out position, course, and distance traveled
4. shelf	d. a rule of conduct or action laid down and enforced by the supreme governing authority of a community or established by custom
5. negotiate	e. to come about as an effect, consequence, or conclusion
6. divide	f. not definite or fixed; not known for sure; likely to change
7. adjacent	g. to give legal or official approval
8. restrict	h. to separate into two or more parts or pieces; to separate into classes or categories
9. navigation	i. to have a discussion with another so as to arrive at an agreement
10. remain	j. to be a part not destroyed; to be something yet to be shown, done, or treated; to stay in the same place or with the same person or group; to continue unchanged
11. uncertain	
12. provisions	

3. READING ROOM FOR STUDENTS OF GEOLOGY

Unit 1.General Geology

Part 1

Exercise 1. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

8. The sudden shaking / is called / when / the Earth's surface / of the ground / an earthquake / masses of rock / that occurs / change position below.
9. The shifting masses / that may be / to alter the surface / in the ground / send out / powerful enough / thrusting up cliffs / shock waves / of the Earth / and / opening great cracks.

Exercise 2. Put the sentences into the proper order. Read the whole paragraph.

1. Some of the rest, however, cause major catastrophes.
2. The oldest chronicle comes from the Chinese as early as the Shang Dynasty more than 3,000 years age.
3. A very great earthquake usually occurs at least once a year in some part of the world.
4. They produce such tragic and dramatic effects as destroyed cities, broken dams, earth slides, giant sea waves called tsunamis, and volcanic eruptions.
5. Others are felt as small tremors.
6. Fortunately, most of them can be detected only by sensitive instruments called seismographs.
7. Humankind has long been concerned about earthquake hazards.
8. According to long-term data of the United States Geological Survey, on average about 10,000 people die each year as a result of earthquakes.
9. Earthquakes, called temblors by scientists, occur almost continuously.

Exercise 3. Fill in the gaps with the words from the box. Read the whole paragraph.

movements	is	certain	shock	Earth	rock	are	frequently	shaking

Although it is (1) … that violent Earth tremors in themselves (2) … destructive, there are often other kinds of Earth (3) … that are triggered by earthquake (4) …. waves. Thus, the violent (5) ….. that accompanies many earthquakes often causes rockslides, snow avalanches, and landslides. In some areas these events are (6) … more devastating than the (7) … tremor itself.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word with its definition.

1. cliff	a. a device to measure and record vibrations of the earth
2. crack	b. the surface of the earth
3. ground	c. a narrow break or opening
4. seismograph	d. a high steep surface of rock, earth, or ice
5. tremor	e. a great sea wave produced especially by an earthquake or volcano eruption under the sea
6. temblor	f. a source of danger
7. tsunami	g. a disturbance similar to a wave in water that transfers energy progressively from point to point
8. eruption	h. a barrier preventing the flow of water
9. hazard	i. a sudden disaster
10. wave	j. a quivering or vibrating motion ; a small movement of the earth before or after an earthquake
11. dam	
12. catastrophe	

(adopted from «earthquake.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2

Fields of Geologic Study

The science of the Earth—Geology—is perhaps the most varied of all the natural sciences. It is concerned with the origin of the planet Earth, its history, its shape, the materials forming it, and the processes that are acting and have acted on it. Geology is one of several related subjects commonly grouped as the Earth sciences, or Geosciences. Geologists are Earth scientists concerned primarily with rocks and materials derived from rocks that make up the outer part of the Earth. To understand these materials, geologists use the knowledge gained in other fields of science such as Physics, Chemistry, and Biology; thus, geological fields—such as Geophysics, Geochemistry, Geochronology, and Paleontology—incorporate other sciences, enabling geologists to understand better the working of Earth processes through time.

Although each Earth science has a particular focus, they all frequently overlap with geology. Thus, the study of the Earth's waters in relation to geological processes involves knowledge of Hydrology and Oceanography. The mapping and measurement of the Earth's surface formations involve knowledge of Cartography and Geodesy, the measurement of the Earth's precise shape and dimensions. Clues to the origin of the Earth are also sought from astronomical studies of extraterrestrial bodies.

The discipline of geology deals with the history of the Earth, including the history of life, and covers all physical processes at work on the surface and in the crust of the Earth. Broadly, geology thereby includes studies of interactions among the Earth's rock, soil, water, atmosphere, and life forms—clearly too wide a field for one scientific discipline to cover as a whole. Geologists therefore generally limit themselves to specialized study in any of a number of fields, brief descriptions of which follow.

Exercise 1. Look through the text and copy out proper names and branches of science.

Exercise 2. What do the proper names or branches of science from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Geology is the most varied of all the natural sciences.
2. Geologists are scientists concerned with rocks and materials derived from rocks.
3. The Earth sciences frequently overlap with geology.
4. The study of the Earth's waters in relation to geological processes involves knowledge of biology and chemistry.
5. The mapping and measurement of the Earth's surface formations involve knowledge of the measurement of the Earth's precise shape and dimensions.
6. Clues to the origin of the Earth are also sought from geological studies of extraterrestrial bodies.
7. The discipline of geology deals with the history of the Earth and covers all chemical processes at work on the surface and in the crust of the Earth.

Exercise 4. Answer the following questions:

1. What sciences is geology the most varied one?
2. The origin of what planet is geology concerned with?

3. What subject is one of several related subjects commonly grouped as the Earth sciences, or geosciences?
4. What knowledge do geologists use to understand better the working of the Earth processes through time?
5. Where can we find clues to the origin of the Earth?
6. What discipline deals with the history of the Earth, including the history of life, and covers all physical processes at work on the surface and in the crust of the Earth?
7. What sciences does geology include?

Exercise 5. Match the word with its definition.

1. rock	a. a rising, beginning, or coming from a source
2. to overlap	b. the loose surface material of the earth in which plants grow
3. origin	c. a drawing or picture showing selected features of an area
4. hydrology	d. the making of maps
5. mapping	e. solid mineral deposits
6. soil	f. to have something in common
7. cartography	g. a science dealing with the characteristics, distribution, and circulation of water on and below the surface of the land and in the atmosphere
8. dimension	h. the action or influence of people, groups, or things on one another
9. interaction	i. a hard surface layer
10. crust	j. measure of extension in one direction or in all directions
11. measurement	
12. geodesy	

(adopted from «geology.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 3

Earth sciences

The studies of the solid Earth and the water on and within it and the air around it are called Earth sciences. Included in the Earth sciences are the geological, the hydrological, and the atmospheric sciences, which are concerned respectively with the nature and behavior of the Earth itself, the water, and the air. The Earth sciences are basically physical sciences that utilize advances in Mathematics, Physics, Chemistry, and, to a smaller extent, Biology.

Geology embraces a number of sciences. Among these is geomorphology, the study of the nature, origin, and processes of change of landforms such as the rising and subsiding of continents and mountains. Geophysics is concerned with the study of the physical phenomena of the Earth such as its magnetic field, the flow of heat from the interior, and the study of gravity, including tides. Seismology is the science of earthquakes. Geochemistry studies the chemical composition of the Earth and the laws governing the distribution of elements within the Earth.

Meteorology, the study of the atmosphere, particularly for forecasting weather, can be considered as the branch of atmospheric physics concerned with the behavior and properties of the Earth's atmosphere. Climatology, the study of past and present climates, is concerned with longer variations than those investigated by meteorologists and is now proving of practical importance in indicating the possible future growth of deserts and glaciated areas.

Hydrology (derived from the Greek word for water, hydro) is concerned with the circulation of water in the atmosphere and the outer parts of the Earth. Oceanography, the study of seas and oceans, began as an aid to navigation and fishing.

Exercise 1. Look through the text and copy out proper names and branches of science.

Exercise 2. What do the proper names or branches of science from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The geological, the hydrological, and the atmospheric sciences are included in the Earth sciences.
2. The Earth sciences are basically geological sciences that utilize advances in Mathematics, Physics, Chemistry, and, to a smaller extent, Biology.
3. Geomorphology is concerned with the study of the physical phenomena of the Earth .
4. Geochemistry studies the chemical composition of the Earth .
5. Meteorology, the study of past and present climates, is concerned with longer variations than those investigated by meteorologists.
6. Hydrology is concerned with the circulation of water in the atmosphere and the outer parts of the Earth.
7. Oceanography is the science of earthquakes.

Exercise 4. Answer the following questions:

1. How are the studies of the solid Earth and the water on and within it and the air around it called?
2. What sciences are included in the Earth sciences?
3. What sciences does geology embrace?
4. What study is Geophysics concerned with?

5. What does Geochemistry study ?
6. How can Meteorology be considered?
7. What is Hydrology?

Exercise 5. Match the word with its definition.

1. landform	a. the manner in which the parts of a thing are put together
2. mountain	b. the internal or inner part of something
3. composition	c. a natural feature of a land surface
4. distribution	d. an elevation higher than a hill
5. interior	e. a shaking or trembling of a portion of the earth
6. gravity	f. to calculate or predict (a future event or state) usually by study and examination of data
7. tide	g. the quality or state of being dignified and proper
8. earthquake	h. dry land with few plants and little rainfall
9. forecasting	i. orderly movement through a circuit
10. desert	j. a separate or subordinate division or part of a central system
11. circulation	
12. branch	

(adopted from «earth sciences.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

<u>Unit 2. Palaeontology</u>

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. And that many plants once grew in the polar.
b. They have learned also that tropical forests once covered the United States and Europe.
c. From fossils scientists have learned also that the ancestors of the camel once roamed the plains of North America.
d. By studying fossils, scientists have been able to piece together some of the important pages in the history of the Earth and its people.
e. Fossils show that the great coal and chalk beds of the world were formed from the remains of living things.
f. They have proved that the Rocky Mountains, the Alps, and the Himalayas

were once below the level of the ocean, for the remains of sea animals have been found high up on their slopes.

g. The science of fossils is called paleontology, from Greek words meaning the science (logia) of very old (palaios) existing things (onta).

Exercise 2. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. Fossils show / of the world / the great coal / the remains of / and / were formed / that / chalk beds / living things / from .
2. Millions / of today / animals / of years ago / that / were making / the limestone / shells / tiny / became.
3. Fitting together / science / the earliest / shellfish / worms / and / the scattered parts of / animal life / the fossil story / back to / has traced.
4. It has shown how, / (half-land, half-water animals such as the frog) / mammals / there appeared / insects / one after another / reptiles / amphibians / and / birds and bony fishes / cartilaginous fishes .

Exercise 3. Fill in the gaps with the words from the box. Read the whole paragraph.

appearance less creatures died out is late smaller great learn

Strangest of all (1) … are the giant monsters of the Era of Reptiles—the dinosaurs, the ichthyosaurs, and other scaled, horny creatures of dragon like (2) …. Those who study fossils (3) … from these remains that the farther back in time an animal lived, the (4) … is the proportion of brain space in its skull. Hundreds of species of (5) … size and strength (6) … and made way for creatures with more brain and (7) … bulk.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word with its definition.

1. slope — a. a black or brownish black solid substance that is formed by the partial decay of vegetable matter under the influence of moisture and often increased pressure and temperature within the earth and that is widely used as a fuel
2. ancestor — b. any of various long creeping or crawling animals (as a grub or tapeworm) that usually have soft bodies
3. coal — c. any of numerous small invertebrate animals (as spiders or centipedes) that are more or less obviously made up of segments — not used technically
4. chalk — d. upward or downward slant or degree of slant
6. limestone — f. a soft white, gray, or buff limestone made up mainly of the shells of tiny saltwater animals and especially foraminifers
7. worm — g. any organism that is able to live both on land and in water; esp: any of a class of cold-blooded vertebrate animals (as frogs and salamanders) that in many respects are between fishes and reptiles
8. shellfish — h. a rock that is formed chiefly from animal remains (as shells or coral), consists mainly of calcium carbonate, is used in building, and gives lime when burned
9. amphibian — i. any of a group of cold-blooded air-breathing vertebrates (as snakes, lizards, turtles, and alligators) that usually lay eggs and have skin covered with scales or bony plates
10. insect — j. an invertebrate animal that lives in water and has a shell; esp: an edible mollusk (as an oyster) or crustacean (as a crab)
11. reptile
12. scull

(adopted from «fossils.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2

Prehistoric life

Because the era known as prehistoric covers the hundreds of millions of years before the first hominids, or humanlike creatures, existed, most prehistoric animals have never been seen by humans. Prehistoric animals evolved in two ways. Early, very simple kinds of animals gradually changed into new and more complex kinds; and the process of adaptation enabled some animals to survive in all parts of the Earth .

While some prehistoric animals died out completely, becoming extinct, the descendants of others are still living on Earth. The best-known extinct animals are dinosaurs, huge animals that disappeared about 65 million years ago. Sponges, corals, starfish, snails, and clams—all familiar creatures today—can be traced back 500 million years or more. Spiders originated almost 400 million years ago. Insects and sharks also have long histories.

Dinosaurs dominated the Earth for more than 150 million years and then vanished. Scientists have many theories to explain this fact. Some say that when flowering plants appeared on Earth about 200 million years ago, they increased the amount of oxygen in the atmosphere, causing dinosaur breathing rates and heartbeats to increase to the extent that the creatures burned themselves out. Other theorists suggest that the dinosaurs were poisoned by plants they ate.

Scientists have learned a great deal about prehistoric life by studying animal skeletons or shells. At times they have found bones and pieced them together. Often the remains were petrified (turned to a stony hardness) and discovered as fossils.

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

paleontology	prehistoric life	dinosaurs	fossils	prehistoric animals

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Because the era known as historic covers the hundreds of millions of years before the first hominids, or humanlike creatures, existed, most prehistoric animals have never been seen by humans.
2. The best-known extinct animals are dinosaurs.
3. Sponges, corals, starfish, snails, and clams can be traced back 500 million years or more.
4. Spiders originated almost 600 million years ago.
5. Dinosaurs dominated the Earth for more than 150 million years and then vanished.
6. Theorists suggest that the dinosaurs were poisoned by fish they ate.
7. Scientists have learned a great deal about prehistoric life by studying skeletons or humanlike creatures.

Exercise 4. Answer the following questions?

1. How did prehistoric animals evolve?
2. What process enabled some animals to survive in all parts of the Earth?
3. What animals are the best-known extinct ones?
4. What familiar creatures of today can be traced back 500 million years or more?
5. When did spiders originate?
6. How many years did dinosaurs dominate the Earth?
7. What theories do scientists use to explain the fact that dinosaurs died out?

Exercise 5. Match the word with its definition.

1.	creature	a.	composed of two or more parts
2.	complex	b.	no longer existing
3.	descendant	c.	any of a group of extinct often very large mostly land-dwelling long-tailed reptiles of the Mesozoic era
4.	extinct	d.	the stony or horny deposit that is composed of the skeletons of various polyps
5.	dinosaur		one coming directly from an earlier and usually similar type or individual
6.	sponge	f.	a reactive element that is found in water, rocks, and free as a colorless tasteless odorless gas which forms about 21 percent of the atmosphere, that is capable of combining with almost all elements, and that is necessary for life see element table
7.	coral	g.	any of an order of arachnids that have two or more pairs of abdominal organs for spinning threads of silk used in making cocoons for their eggs, nests for themselves, or webs for catching their prey
8.	plant	h.	a trace or print or the remains of a plant or animal of a past age preserved in earth or rock
9.	spider	i.	a springy mass of fibers and spicules that forms the skeleton of a group of aquatic animals and is able to absorb water freely
10.	oxygen	j.	to convert into stone or a stony substance by the penetration of water and the depositing of minerals which were dissolved in the water
11.	fossil		
12.	to petrify		

(adopted from «animal, prehistoric.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 3

Kinds of Fossils

Fossils are remains of ancient life. There are many different kinds, because countless animals and plants lived in the past and they were preserved in many different ways. Sometimes the actual bone or tooth of an extinct animal was preserved in hot, dry locations. In moist places the original bone material was replaced, cell by cell, with minerals. It thus became fossilized, or petrified. If the once-living thing was a tree, the fossil may be a part of the tree trunk which underwent replacement of woody material with minerals.

The fossil may be what is called a stone core. The shell of an ancient snail, for example, filled with fine sand after the animal died. Eventually the shell itself disintegrated, but meanwhile the sand that filled it had turned to stone. The stone exactly reproduced the inner shape of the shell. Sometimes the body of an animal was buried. It decayed and left a hollow mold which filled up with mineral matter, forming a cast of the animal's shape.

The fossil may be simply a print. The footprint of a prehistoric animal may have been preserved under layers of sand or silt. Prints are known of fishes, of butterfly like insects, and even of jellyfish. The delicate imprint of a leaf or blossom on some soft material may have later hardened into solid rock. Many different kinds of plants left leaf prints.

Another kind of fossil is called an inclusion. The object is usually small—an insect or a small piece of a plant, such as a blossom. It became embedded in the flowing resin of a pine like tree. The resin fossilized into amber, and the embedded insect became a fossil too.

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

footprint	stone core	spiders	extinct animal	animal skeletons

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Fossils are remains of ancient life.
2. Sometimes the actual bone or tooth of an extinct animal was preserved in cold, dry locations.
3. The fossil may be what is called a stone core.
4. The shell of an ancient snail, for example, filled with coarse sand after the animal died.
5. The footprint of a prehistoric animal may have been preserved under layers of limestone or silt.
6. Many different kinds of plants left leaf prints.
7. Another kind of mineral is called an inclusion.

Exercise 4. Answer the following questions:

1. Where was the actual bone or tooth of an extinct animal preserved?
2. How was the original bone material replaced in moist places?
3. How did the shell of an ancient snail change?
4. What is a fossil?
5. Under what layers may the footprint of a prehistoric animal have been preserved?
6. What did many different kinds of plants leave?
7. How is another kind of fossil called?

Exercise 5. Match the word with its definition.

1. remain	a. a place fit for or having some particular use
2. to preserve	b. a hard yellowish partly transparent resin from trees long dead that can be highly polished and is used for ornamental objects (as beads)
3. location	c. a dead body
4. fine	d. to keep or save from injury, loss, or ruin
5. to disintegrate	e. light rich crumbly earth that contains decaying matter
6. inclusion	f. the material substance that occupies space, has mass, and makes up the observable universe
7. mold	g. not thick, coarse, or dull
8. matter	h. to break or decompose into the elements, parts, or small particles making up something
9. sand	i. a track left by the foot
10. footprint	j. a deposit of sediment (as by a river)
11. silt	

(adopted from «fossils.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Unit 3. Mineralogy

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. The fire opal has an internal iridescence of intense orange to red.
b. Diatomaceous earth, or diatomite, was formed from the siliceous shells of diatoms, microscopic algae found in fresh water and seawater.
c. The oxide group includes the silicon oxide quartz, also called silica.
d. Siliceous sinter, or geyserite, is an impure quartz deposited by hot springs and is a form of opal.
e. Semiprecious gem stones of quartz include amethyst, tigereye, agate, and onyx.
f. The powdery substance is used for insulating and filtering material and in the manufacture of polishing and scouring powders.
g. One of the most common minerals, quartz occurs in many areas in a variety of forms.
h. Another abundant oxide of silicon is tridymite.
i. It is also called kieselguhr and tripolite.

Exercise 2. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph .

1. Among / are / zincite, or zinc oxide / rutile, or titanium oxide / the oxides of metals / cassiterite, or tin oxide / that / cuprite, or copper oxide / exist as minerals .
2. Pyrolusite / the chief / of / manganese oxide / ore / is / manganese / or.
3. Among / of / the oxides hematite / are / the ores / magnetite / and / iron .

4. Lodestone , / is / magnetite / of / natural / a / magnet / a form .
5. Ilmenite, / and / a mixed oxide / which / iron / of / exists / is / in large deposits / magnetite.
6. It is / a purifier in alloys / of / as / the titanium / as / used / and / a chief source / a paint pigment .

Exercise 3. Fill in the gaps with the words from the box. Read the whole paragraph.

granular	corundum	manganese oxide	makes up	exists	chief
source	major components	is used	is		

Aluminum oxide, known in mineralogy as (1) … (and in an impure form as bauxite), (2) … in two transparent and colored gem forms—sapphire and ruby. Emery, a black (3) … corundum mixed with iron minerals, (4) … in a powdered form for grinding and polishing. Spinel is a mixed oxide of magnesium and aluminum, and chromite (5) … an iron and chromium oxide that (6) … the chief ore of chromium. Chromium is one of the (7) … of stainless steels.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word with its definition.

1. oxide	a. a common mineral consisting of silicon dioxide that is often found in the form of colorless transparent crystals but is sometimes (as in amethysts, agates, and jaspers) brightly colored
2. silica	b. a clear purple or bluish violet variety of crystallized quartz used as a gem
3. quartz	c. chalcedony in parallel layers of different color
4. amethyst	d. a compound of oxygen with another element or a chemical group
5. agate	e. a compound that consists of the dioxide of silicon and occurs in various forms (as in quartz, opal, and sand)
6. onyx	f. a smooth-looking quartz having its colors arranged in stripes or forms that look like clouds or moss
7. semiprecious	g. a reddish metallic element that is one of the best conductors of heat and electricity see element table
8. diatom	h. a silvery gray light strong metallic element found combined in various minerals and used especially in alloys (as in steel) see element table
9. cassiterite	i. less value than a precious stone

10. copper	j. any of a class of minute floating single-celled or colonial algae that are common in fresh and salt water and have a cell wall of silica that remains as a skeleton after death
11. titanium	
12. aluminium	

(adopted from «mineral.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2
Mineral Identification

The names of most minerals, usually ending in the suffix -ite, are a kind of shorthand description or history of their substance. Some are named for the scientists who discovered them, others for the locations where they were first found, and still others for outstanding physical or chemical properties.

Mineralogists identify minerals by certain important properties. These include color, hardness, and cleavage, the ability of the mineral to split along definite planes. Other means of distinguishing a mineral are its elasticity and strength, specific gravity, radioactivity, and thermal, electrical, and magnetic properties. Luminescence, or the emission of light, sometimes permits rapid detection of some minerals, including some uranium ores.

Related to the color of a mineral are its transparency, luster, and iridescence, or the play of colors in its interior or exterior. The streak, another property that identifies a mineral, is the color produced when a piece of the mineral is rubbed against the surface of rough, unglazed porcelain.

The hardness of minerals is usually stated in terms of the Mohs scale. On this scale, a comparison is made of ten typical minerals, which are arranged in order from the softest to the hardest. They are: (1) talc; (2) gypsum; (3) calcite; (4) fluorite; (5) apatite; (6) orthoclase; (7) quartz; (8) topaz; (9) corundum; and (10) diamond. The hardness of a mineral that can scratch orthoclase but is itself scratched by quartz is between 6 and 7 on the Mohs scale.

The crystal form of minerals determines their cleavage, or the way they split or break, as well as many other properties. Mica, for example, splits into thin, flat sheets.

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

the oxides of metals	gem stones	the hardness of minerals	important properties
the color of a mineral			

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Some minerals are named for the scientists who discovered them, others for the locations where they were first found, and still others for outstanding physical or chemical properties.
2. Mineralogists identify minerals by certain chemical properties.
3. Related to the color of a mineral are its elasticity and strength, specific gravity, radioactivity, and thermal, electrical, and magnetic properties.
4. The streak is the color produced when a piece of the mineral is rubbed against the surface of rough, unglazed porcelain.
5. The hardness of minerals is usually stated in terms of the Mohs scale.
6. On this scale, a comparison is made of nine typical minerals, which are arranged in order from the softest to the hardest .
7. The crystal form of minerals determines their cleavage, or the way they split or break.

Exercise 4. Answer the following questions:

1. How are some minerals named?
2. How do mineralogists identify minerals?
3. What is a streak?
4. How is the hardness of minerals usually stated?
5. How many minerals are on this scale?
6. How are these minerals arranged?
7. What does the crystal form of minerals determine?

Exercise 5. Match the word with its definition.

1. cleavage	a. a very soft mineral that consists of a silicate of magnesium, has a soapy feel, and is used especially in making talcum powder
2. ore	b. a mineral substance made up of calcium carbonate and found in numerous forms including limestone, chalk, and marble
3. talc	c. a transparent or nearly transparent mineral of different colors that consists of a fluoride of calcium and is used as a flux and in making glass
4. gypsum	d. any of a group of variously colored minerals that are phosphates of calcium and that are used as a source of phosphorus and its compounds
5. calcite	e. a very hard mineral of aluminum oxide used for grinding, smoothing, or polishing or in some crystalline forms as a gem (as ruby or sapphire)
6. fluorite	f. a very hard stone of crystallized carbon that is used as a precious gem and industrially as a powder for grinding, smoothing, or polishing and in cutting tools
7. apatite	g. a mineral in the form of usually yellow to brownish yellow crystals that is valued as a gem
8. orthoclase	h. a colorless mineral that consists of calcium sulfate occurring in crystals or masses and that is used especially as a soil improver and in making plaster of paris
9. quartz	i. the quality of a crystallized substance or rock of splitting in definite directions
10. topaz	j. a mineral consisting especially of potassium feldspar
11. corundum	
12. diamond	

(adopted from «mineral.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 3

Silicate Minerals

The most widespread and numerous minerals are the silicates. They consist of silicon and oxygen combined with potassium, sodium, magnesium, aluminum, and many other elements.

Feldspars make up the most prominent group of silicates. They include orthoclase, a potassium and aluminum silicate; albite, which contains sodium instead of potassium; and oligoclase, which contains calcium in addition to sodium.

Another important silicate group includes the micas. Muscovite is the transparent mica used as an insulating material in the manufacture of electrical equipment. It consists primarily of silicate of potassium and aluminum. As isinglass it is used in devices such as stove doors and lantern shields.

A second common mica is biotite, which contains magnesium and iron; it is usually dark green, brown, or black. Another mica is lepidolite, a fluosilicate of potassium, aluminum, and lithium. Lepidolite is one of the few ores that contains the metal lithium.

The pyroxene family contains a series of rock-forming minerals, as do the feldspar and mica groups. Two common pyroxenes are diopside, a silicate of calcium and magnesium, and augite, which contains some iron and aluminum. One variety of pyroxene is spodumene, a lithium aluminum silicate. It is sometimes found in a clear, pink crystal form called kunzite, which is used as a gem. A green variety is called hiddenite. Jadeite is another pyroxene. A true jade, it is sometimes called Chinese jade.

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

the pyroxene family typical minerals silicates the Mohs scale the micas

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The silicates are the most widespread and numerous minerals.
2. They consist of silicon and hydrogen combined with potassium, sodium, magnesium, aluminum, and many other elements.
3. Feldspars make up the most prominent group of silicates.
4. Another important mineral group includes the micas.
5. Muscovite is the transparent feldspar used as an insulating material in the manufacture of electrical equipment.
6. The pyroxene family contains a series of rock-forming minerals, as do the feldspar and mica groups.
7. Jadeite is sometimes called Chinese jade.

Exercise 4. Answer the following questions:

1. What minerals are the most widespread and numerous?
2. What minerals do the silicates consist of?
3. What minerals make up the most prominent group of silicates?
4. What is muscovite?
5. What is biotite?
6. What does the pyroxene family contain?
7. What is jadeite?

Exercise 5. Match the word with its definition.

1. silicate	a. a silver-white soft light metallic element that has a low melting point and occurs abundantly in nature especially combined in minerals see element table
2. silicon	b. a soft waxy silver-white metallic element that is chemically very active and is common in nature in combined form see element table
3. potassium	c. any of various minerals that contain silicon and can be separated easily into thin often transparent sheets
4. sodium	d. any of a group of crystalline minerals that consist of silicates of aluminum with potassium, sodium, calcium, or barium and that are a basic part of nearly all crystalline rocks
5. magnesium	e. a chemical salt that consists of a metal combined with silicon and oxygen and is used especially in building materials (as bricks)
6. albite	f. nonmetallic element that occurs combined as the most abundant element after oxygen in the earth's crust and is used especially in alloys and electronic devices see element table
7. biotite	g. any of various silicate minerals that usually contain aluminum, calcium, sodium, magnesium, or iron
8. mica	h. silver-white metallic element that is light and easily worked, burns with a dazzling light, and is used in making lightweight alloys see element table
9. feldspar	i. a usually valuable stone cut and polished for ornament
10. gem	j. a tough usually green gemstone that takes a high polish
11. pyroxene	
12. jade	

(adopted from «mineral.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 200

Unit 4. Petrology

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. They are dark because they contain iron and magnesium.
b. Oxygen and silicon, for example, are the two most common elements.
c. The Earth in its beginning was a mass of molten matter, or magma.
d. As the magma cooled and condensed, its elements combined to form minerals.
e. They combine to form quartz, one of the most abundant of the minerals.
f. It contained the elements, which are the building blocks of all matter.
g. A different combination of elements produces the mineral feldspar.
h. The only ones that occur in large enough masses to be important as rock builders, however, are quartz, feldspar, and a group called the ferromagnesian minerals.
i. The word igneous comes from the Latin ignis, meaning «fire.»
j. Scientists know about 1,500 minerals.
k. Igneous rocks were never actually on fire, but they were formed from very hot molten material.
l. This group includes hornblende, pyroxene, biotite (black mica), olivine, and magnetite.
m. Igneous rocks were the first rocks.

Exercise 2. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. Sedimentary / features / can / two / rocks / recognized / be / by .
2. First, / the igneous rocks / they are / such as / made up of / older formations / materials / a part of / once were / that .
3. Second, / strata / because of / called / the sorting action of / they / the water / lie in layers / in which / they lie / they were laid down .
4. So / sedimentary / it is said / rocks / are / that / stratified.
5. Much of / rocks / the North American / sedimentary / continent / with / is mantled .
6. They / the Earth / on top of / have been raised / the real crust of / the sea / that mark / where / the older igneous rocks / they were formed / from the floor of.

Exercise 3. Fill in the gaps with the words from the box. Read the whole paragraph.

sedimentary metamorphic igneous crust from Earth's crust made up dissolves produce

The third group of rocks is the (1) … The term comes (2) … a Greek word meaning «change of form.» Metamorphic rocks can be formed from both (3) … and (4) …rocks. The forces that (5) …them are 1) pressure and heat resulting from the shrinking and folding of the (6) …; 2) water action, which (7) …and redeposits minerals; and 3) the action of hot magma on old rocks.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word or phrase with its definition.

1.	hornblende	a.	a usually greenish mineral that is a silicate of magnesium and iron
2.	biotite	b.	to form by fitting together or assembling
3.	olivine	c.	to bend (as a layer of rock) into folds
4.	magnetite	d.	to mix or cause to mix with a liquid so that the result is a liquid that is the same throughout
5.	to make up	e.	a dark mineral commonly found as a kind of rock
6.	formation	f.	a generally black or dark green mica containing iron, magnesium, potassium, and aluminum
7.	strata	g.	a black mineral that is an oxide of iron, is strongly attracted by a magnet, and is an important iron ore
8.	to stratify	h.	a bed of rocks or series of beds recognizable as a unit
9.	shrinking	i.	to form, deposit, or arrange in layers
10.	folding	j.	a layer of a substance ; esp: one of a series of layers
11.	redeposit		
12.	to dissolve		

(adopted from «rock.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2
What is Petrology

Petrology deals with the origin, occurrence, structure, and history of rocks, particularly igneous and metamorphic rocks. Petrography, a related discipline, is concerned with the description and characteristics of rocks. Petrologists study changes that occur in rock masses when magmas solidify, when solid rocks melt partially or wholly, and when sediments undergo chemical or physical transformation. Workers in this field are concerned with the crystallization of minerals and solidification of glassy minerals from molten materials at high temperatures, the recrystallization of minerals at high temperatures without their passing through a molten phase, the exchange of ions between minerals in solid rocks and fluids, and processes that include weathering, transport, and deposition. Also essential to this field is the careful mapping and sampling of rock units.

The Earth's building materials are the rocks. Rocks are combinations of minerals in varying proportions. A rock may be made up of one or more minerals. Pure sandstone, for example, consists only of the mineral quartz. Granite is composed chiefly of three minerals—quartz, feldspar, and mica. A «recipe» with different mineral ingredients results in a different kind of rock.

The solid crust of the Earth is rock. The soil itself is made up largely of rock which has been broken down by weathering. Beneath the Earth's solid crust are pockets of molten rock, called magma.

Certain hard substances formed from the remains of animals and plants are also called rock. Coal, which is composed of plant material, is an example. Limestone contains the shells and skeletons of sea creatures and limy masses built by plants.

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

sedimentary rocks petrography recrystallization of minerals oxygen and silicon pockets of molten rock

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Petrology , a related discipline, is concerned with the description and characteristics of rocks.
2. Petrography deals with the origin, occurrence, structure, and history of rocks, particularly igneous and metamorphic rocks.
3. Petrologists study changes that occur in rock masses when magmas solidify, when solid rocks melt partially or wholly, and when sediments undergo chemical or physical transformation.
4. Rocks are the Earth's building materials.
5. Rocks are combinations of minerals in varying proportions.
6. Granite is composed chiefly of two minerals—quartz, feldspar.
7. Certain hard substances formed from the remains of animals and plants are also called magma.

Exercise 4. Answer the following questions:

1. What is petrology?
2. What is petrography concerned with?
3. What do petrologists study?
4. What are rocks?
5. What is the solid crust of the Earth?
6. How are pockets of molten rock called?
7. What does limestone contain?

Exercise 5. Match the word or phrase with its definition.

1. occurrence	a. the action or process of depositing
2. igneous rock	b. the action of the forces of nature that changes the color, texture, composition, or form of exposed objects; esp: the physical and chemical breakdown of earth materials at or near the earth's surface
3. metamorphic rock	c. an act or process of transporting
4. magma	d. solid mineral deposit formed by hardening of melted earth
5. solidification	e. to judge the quality of by a sample
6. deposition	f. the presence of a natural form or material in a particular place
7. weathering	g. solid mineral deposit changed into a more compact form by the action of pressure, heat, and water
8. recrystallization	h. molten rock material within the earth
9. transport	i. the outer covering of a nut, fruit, or seed especially when hard or tough
10. 10 sampling	j. to form or cause to form crystals after being dissolved or melted
11. 11 limy mass	
12. shell	

(adopted from «rock.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 3

The Earth's History Told in Rocks and Rock Collecting

The rocks tell a fascinating story of the origin and history of the Earth—a story that goes back millions of years. They tell of giant explosions; of mountains that rose from the sea and then were worn down to plains; of seas that invaded the land and then retreated or dried up. They tell of blankets of ice and of buried forests that turned to stone. The scientists who can read this story of the Earth are called geologists.

All rocks fall into one of three groups, according to how they were formed. These groups are igneous, sedimentary, and metamorphic rocks.

Collecting rocks and minerals is a popular and worthwhile hobby. It combines outdoor Exercise with indoor study. Learning to identify the minerals and fossils in rocks may lead to a career in such rewarding sciences as chemistry, physics, geology, physical geography, or paleontology.

Amateur collectors call themselves rockhounds. With a little inexpensive equipment, such as a hammer and chisel, a notebook, a magnifying glass, and a rock hunter's guidebook, a collector is ready to gather specimens.

Rocks and minerals can be picked up almost anywhere—quarries and mines, road cuts, building excavations, beaches, streambeds, rock outcroppings, and exposed cliffs. Most rockhounds specialize, rather than try to collect all the 1,500 known minerals. Colorful and beautifully shaped crystals are prized by all collectors. Petrified woods and fossils are interesting specialties.

Collections of semiprecious stones such as agates, zircons, garnets, and amethysts may lead to gem cutting and jewelry making. This offshoot of mineral collecting has become a major hobby in itself.

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

semiprecious stones	collecting rocks and minerals	occurrence
weathering	rockhounds	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The rocks tell a fascinating story of the origin and history of the Earth—a story that goes back millions of years.
2. The scientists who can read this story of the Earth are called amateur collectors.
3. All rocks fall into one of three groups, according to how they were formed .
4. These groups are magmatic, sedimentary, and metamorphic rocks.
5. Amateur collectors call themselves rockhounds .
6. Most rockhounds specialize, rather than try to collect all the 1,600 known minerals.
7. Collections of precious stones such as agates, zircons, garnets, and amethysts may lead to gem cutting and jewelry making.

Exercise 4. Answer the following questions:

1. What story do the rocks tell?
2. How are the scientists who can read this story of the Earth called?
3. What groups do all rocks fall into?
4. What hobby is a popular and worthwhile one?
5. How do amateur collectors call themselves?
6. What do they do?
7. Where can rocks and minerals be picked up?

Exercise 5. Match the word or phrase with its definition.

1. explosion	a. a power tool for pounding
2. blanket	b. a lens that magnifies an object seen through it
3. to collect	c. a transparent usually red mineral used as a gem or for grinding, smoothing, or polishing
4. equipment	d. to gather from a number of sources
5. hammer	e. the act or an instance of exploding
6. chisel	f. covering all instances or members of a group or class
7. magnifying glass	g. an animal hunted as game or prey
8. specimen	h. a mineral that consists of a silicate of zirconium and occurs usually as brown or grayish crystals or sometimes as transparent forms which are used as gem
9. mine	i. a metal tool with a cutting edge at the end of a blade used to shape or chip away a solid material (as stone, wood, or metal)
10. 10 quarry	j. a part or a single thing that shows what the whole thing or group is like
11. 11 zircon	
12. garnet	

(adopted from «rock.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

<u>Unit 5. Geophysics</u>

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. These deposits are found in beds, or seams, between layers of rock.
b. The mining method used to extract these flat deposits is rather straightforward.
c. The method used to mine a specific commodity depends chiefly on the shape and location of the deposit.
d. Examples of flat, or tabular, deposits are those of coal, potash, salt, and oil shale.
e. The material above the seam is called the overburden.
f. Mining of deposits that are not flat and continuous, however, requires using one of a variety of methods to extract these deposits either from the surface or from under the ground.
g. The method used depends on the geometry, size, and altitude of the deposit.
h. In many instances, the deposit is relatively flat and continuous over a large area.

Exercise 2. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph .

1. The main objective / to the surrounding environment / is / economically / the valuable material / and / / in any kind / to remove / with minimum damage / of mining / economically / safely .
2. Some of the minerals / have been mined / to use right / produced / are / produced / after / ready / coal and salt / they / such as .
3. It may be / remain essentially unchanged / to wash or treat / but / necessary / their properties / in different ways / these commodities / to enhance their quality.

Exercise 3. Fill in the gaps with the words from the box. Read the whole paragraph.

chemicals	commodities	objective	host	to recover	to wash	nature
techniques	must					

Metals and some mineral (1)… conversely, usually occur in(2)…as ores—that is, combined with other materials. This means that they (3)…be treated, usually with (4)…or heat, to separate the desired metal from its (5)… material. These processing (6)… can be very complex and expensive, but they are necessary (7)… the metal or other mineral commodity of interest.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word with its definition .

1. commodity	a. any of numerous compounds formed by replacement of part or all of the hydrogen of an acid by a metal or by a group acting like a metal
2. potash	b. to be found or met with
3. salt	c. a loss or harm caused by injury to one's person or property
4. oil shale	d. a mineral mined to obtain a substance that it contains
5. to occur	e. a substance (as an element or compound) obtained from a chemical process or used to get a chemical result
6. altitude	f. potassium or a potassium compound
7. damage	g. a product of agriculture or mining
8. to enhance	h. a rock (as shale) from which oil can be recovered
9. property	i. to increase or improve in value, desirability, or attractiveness
10. ore	j. to discuss terms of agreement with
11. chemical	
12. to treat	

(adopted from   «mine and mining.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2

The Beginning of the Petroleum Industry

In the mid-1850s two things occurred to stimulate the petroleum industry: machines that required lubricating oils were developed, and oil lamps were used to light homes and offices. The whale oil used in lamps had become expensive. In 1849 the Scotsman James Young patented a process for converting coal into coal oil. A similar process was developed at the same time by the Canadian Abraham Gesner. He named his product kerosene, after the Greek words for «oil» and «wax.» Coal oil and kerosene

were less expensive than whale oil but smoked and had a disagreeable odor. In 1857 A.C. Ferris, a lamp maker, produced a clean-burning kerosene that did not have a bad smell.

The Pennsylvania Rock Oil Company obtained oil for making kerosene by skimming the oil off natural seeps. After the company went bankrupt, Edwin L. Drake leased its lands and formed the Seneca Oil Company. Drake drilled into an oil seep on Oil Creek, near Titusville, Pa., with a drilling rig used for brine wells. The well produced oil at the rate of 20 barrels per day. This marked the beginning of an oil boom. During the 1860s oil drilling expanded to West Virginia, New York, Ohio, Kansas, Kentucky, Tennessee, Colorado, and California. In 1870 John D. Rockefeller founded the Standard Oil Company, which soon gained a near monopoly on oil production. From 1859 to 1900 the main petroleum product was kerosene for lamps. Lubricants and some fuel oils also came into use.

Primitive rotary drilling rigs were introduced in the 1880s. In 1901, the first modern rotary rig was used at the Spindletop oil field, on a salt dome in Texas. The discovery well alone—a gusher—increased oil production in the United States by 50 percent and world production by 20 percent.

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. What do the proper names or numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. In the mid-1860s two things occurred to stimulate the petroleum industry: machines that required lubricating oils were developed, and oil lamps were used to light homes and offices.
2. In 1849 the Scotsman James Young patented a process for converting coal into coal oil.
3. Coal oil and kerosene were more expensive than whale oil but smoked and had a disagreeable odor.
4. The Pennsylvania Rock Oil Company obtained oil for making kerosene by skimming the oil off natural seeps.
5. In 1870 John D. Rockefeller founded the Standard Oil Company.
6. From 1853 to 1900 the main petroleum product was kerosene for lamps.
7. Primitive rotary drilling rigs were introduced in the 1880s.

Exercise 4. Answer the following questions:

1. What things occurred to stimulate the petroleum industry in the mid-1850s?
2. What did the Scotsman James Young do in 1849?
3. What did A.C. Ferris produce in 1857?
4. What did Edwin L. Drake do?
5. What company did John D. Rockefeller found in 1870?

6. What products came into use from 1859 to 1900?
7. When was the first modern rotary rig used?

Exercise 5. Match the word or phrase with its definition.

1.	petroleum	a.	to flow or pass slowly through small openings
2.	whale oil	b.	something (as a grease or oil) capable of reducing friction when applied between moving parts
3.	coal oil	c.	a hole made in the earth to reach a natural deposit (as of water, oil, or gas)
4.	to skim	d.	tackle, equipment, or machinery fitted for a certain purpose
5.	to seep	e.	an oily flammable liquid that may vary from almost colorless to black, is obtained from wells drilled in the ground, and is the source of gasoline, kerosene, fuel oils, and other products
6.	to drill	f.	an oil obtained from the blubber of whales and formerly used especially in lamps
7.	fuel oil	g.	petroleum or a refined oil prepared from it
8.	lubricant	h.	to clear a liquid of scum or floating substance : remove (as film or scum) from the surface of a liquid
9.	well	i.	an oil that is used for fuel and that usually ignites at a higher temperature than kerosene
10.	rig	j.	complete control over the entire supply of goods or a service in a certain market
11.	barrel		
12.	monopoly		

(adopted from «petroleum.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 3

Source and reservoir rocks

Both crude oil and natural gas are formed from ancient dead plant and animal material that lies buried in layers of sedimentary rock. Black shales—the most common source rocks—were formed from very fine-grained muds. A minimum temperature of 120° F (49° C) is necessary to start the process of natural generation of crude oil. Temperatures increase with depth. Oil is generated at temperatures between 120° F (49° C) and 350° F (177° C), which occur at depths between about 5,000 feet (1,500 meters) and 21,000 feet (6,400 meters). The area in the crust of the Earth where oil is generated from the source rock is called the oil window. Heavy oils are generated at the lower temperatures found in shallower parts of the oil window, whereas lighter oils are generated at the higher temperatures found in the deeper levels.

The generation of crude oil from organic matter in a source rock requires at least several million years. When the temperatures at depths below the oil window exceed 350° F (177° C), natural gas is formed. Any crude oil buried deeper is almost instantaneously changed into natural gas and graphite.

Large amounts of water exist in subsurface rocks. Once crude oil and natural gas have formed, they rise to the surface because they weigh less than the water. Oil and gas flow slowly through the natural fractures in the subsurface rocks. As they rise, they sometimes hit a layer of reservoir rock—a sedimentary rock that contains tiny spaces called pore spaces. Sandstone and limestone are common reservoir rocks. The percent volume of pore spaces in a rock is called porosity. Oil and gas flow from pore space to pore space up the angle of the reservoir rock layer toward the surface. Permeability is a term used to describe how easily a fluid flows through a rock .

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. What do the proper names or numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Both crude oil and natural gas are formed from ancient dead plant and animal material that lies buried in layers of igneous rock.
2. Black shales—the most common source rocks—were formed from very fine-grained sediments.
3. Temperatures increase with depth.
4. The area in the crust of the Earth where oil is generated from the source rock is called the oil window.
5. Heavy oils are generated at the higher temperatures found in the deeper levels, whereas lighter oils are generated at the lower temperatures found in shallower parts of the oil window.
6. Large amounts of water exist in subsurface rocks.
7. Sandstone and limestone are common reservoir rocks.

Exercise 4. Answer the following questions:

1. How were black shales formed?
2. What temperature is necessary to start the process of natural generation of crude oil?
3. What is the oil window?
4. How are heavy oils generated?
5. How are lighter oils generated?

6. What exists in subsurface rocks?
7. What is porosity?

Exercise 5. Match the word or phrase with its definition.

1. crude	a. a soft shiny black carbon that is used in making lead pencils and as a dry lubricant
2. ancient	b. the quality or state of being permeable
3. sedimentary rock	c. a rock made of sand held together by a natural cement
4. source rock	d. a tiny opening area set apart or available
5. graphite	e. the quality or state of being porous
6. subsurface rock	f. of or relating to a period of time long past
7. sandstone	g. being in a natural state and not changed by cooking or refining
8. pore space	h. solid mineral deposit formed by or from sediment
9. porosity	i. a place where something is kept in store ;
10. reservoir	j. a fluid (as hydrogen or air) that has no fixed shape and tends to expand without limit
11. gas	
12. permeability	

(adopted from «petroleum.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Unit 6. Geological Oceanography

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a. Some of the debris are carried all the way to the oceans by rivers .
b. There are mountains, canyons, and plains on the floor of the oceans just as they are on the surface of the continents.
c. They carry mud and silt from the higher slopes of the ocean floor down to the depths.
d. On the continents, many forces of erosion, primarily by water, are constantly at work.
e. Other forces, such as winds and temperature changes, also help wear away the high mountains.

f. Changes take place in the features of the ocean floor as well as in those of the continents.
g. They wear away the mountains and carry the dirt and rocks down to the lower valleys and plains.
h. They also cause some erosion of the surface features of the ocean floor.
i. In the oceans, there are few rainstorms and only very slight temperature changes.
j. But there are forces that act somewhat like winds.
k. These are the deep ocean currents, called turbidity currents .

Exercise 2. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. Many / of square miles / that / broad, flat plains / cover / hundreds / of the continents / of thousands / have.
2. Among / in South America / are / the prairies of North America / and / the steppes of Russia / these / the Amazon Basin .
3. The deep / plains / called / oceans / abyssal / have / plains / also / broad.
4. The abyssal plain/ is / (6,000 meters) / the ocean / in the North Atlantic Ocean / surface / below / 20,000 feet.
5. Most of it / there / completely level / here / is / a few / and / submarine mountains / almost / but / jut up.

Exercise 3. Fill in the gaps with the words from the box. Read the whole paragraph.

definite ridges level ocean square miles reason ranges near by

Just as there are mountain (1) … on the continents, so there are mountain (2) … across the (3) … floor. These ridges, which seem to be organized (4) ….patterns, are generally (5)... the center of the ocean basin. For this (6) … they are called mid-ocean ridges (7) … scientists.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word with its definition .

1. to carry	a. a storm of or with rain
2. debris	b. soft wet earth
3. rainstorm	c. to stick out, up, or forward
4. current	d. the shape or appearance of something
5. mud	e. the remains of something broken down or destroyed
6. to jut up	f. to support and take from one place to another
7. mountain	g. a filthy or soiling substance (as mud, dust, or grime)
8. feature	h. a broad area of level or rolling treeless country

9. dirt — i. an elevation higher than a hill
10. silt — j. the part of a fluid body moving continuously in a certain direction
11. plain
12. slope

(adopted from»Earth.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2
The Continents and Ocean Basins

Geological oceanography is one of the broadest fields in the Earth sciences. Researchers in this branch of oceanography are involved in the study of the topography, structure, and geological processes of the ocean floor

The largest features of the Earth's surface are the continents and ocean basins. The four major ocean basins (Arctic, Atlantic, Indian, and Pacific) are bound by landmasses and major oceanic ridges. Each continent is rimmed by a submerged, gently sloping continental margin. This includes the relatively flat continental shelf, generally found at depths of less than 600 feet (183 meters) with a width of a few miles to more than 200 miles (322 kilometers). At the shelf break portion of the margin, there is a rise in the continental shelf before the continental slope begins its plunge to the deep-sea bottom. Deep submarine canyons frequently cut into the continental margin ocean floor.

The oceanic crust is typically composed of three layers that overlie the mantle. Unconsolidated sediments, averaging about a third of a mile in thickness, make up the top layer. Next is the consolidated volcanic layer, about a mile thick. It is thinner in shallow water and thicker in the Pacific than in the Atlantic Ocean. On the bottom is the basaltic or oceanic layer, about 3 miles (5 kilometers) in thickness. It is principally composed of rocks rich in magnesium and iron, especially basalt.

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. What do the proper names or numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?
1. Geographical oceanography is one of the broadest fields in the Earth sciences .
2. The continents and ocean basins are the largest features of the Earth's surface .

3. The five major ocean basins (Arctic, Atlantic, Indian, and Pacific) are bound by landmasses and major oceanic ridges .
4. Deep submarine canyons frequently cut into the continental margin ocean floor.
5. The earth crust is typically composed of three layers that overlie the mantle.
6. Unconsolidated sediments make up the top layer.
7. Next is the consolidated volcanic layer, about a mile thick.

Exercise 4. Answer the following questions:
1. What is geological oceanography?
2. What are the largest features of the Earth's surface?
3. How many ocean basins are bound by landmasses and major oceanic ridges?
4. What do deep submarine canyons frequently cut into?
5. What is oceanic crust typically composed of?
6. What do unconsolidated sediments make up?
7. What is a consolidated volcanic layer?

Exercise 5. Match the word with its definition.

1. topogrphy	a. a great hollow area in the surface of the lithosphere filled by an ocean
2. continent	b. boundary area
3. basin	c. one thickness or fold over or under another
4. ridge	d. the portion of the earth lying between the crust and the core
5. margin	e. material (as stones and sand) deposited by water, wind, or glaciers
6. shelf	f. one of the great divisions of land (as North America, South America, Europe, Asia, Africa, Australia, or Antarctica) on the globe
7. submarine	g. the art or practice of showing on maps or charts the heights and depths of the features of a place
8. layer	h. a raised or elevated part or area
9. mantle	i. a dark gray to black usually fine-grained igneous rock
10. sediment	j. the quality or state of being thick
11. thickness	
12. basalt	

(adopted from «oceanography.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 3

Clastic sedimentation and chemical and biological deposition

Most clastic sediment—rock and soil eroded from the land—is first deposited on the continental shelf, mainly in tidal environments, in deltas, and along beaches. The rest of the sediment continues out to sea. Winds and currents carry fine-grained particles offshore where they ultimately settle to the ocean floor. Along the continental margins, sediment is carried by turbidity currents that flow downhill because they are denser than the surrounding water. These underwater avalanches help explain the formation of submarine canyons, continental rises, and the flat abyssal plains of the deep-sea floor. Deposits of the rise and abyssal plain consisting of graded beds of sand, silt, and clay that have formed in this way are called turbidites.

Most of the near-shore and shallow-water sediments are calcareous—consisting of calcium carbonate derived from the shells or hard coverings of dead marine animals. Some of the larger contributors include clams, mussels, oysters, scallops, snails, and slugs; smaller sources are the microscopic plants and animals of the sea, including those that make up coral and algal reefs.

Deep-sea deposits are located in less than 13,000 feet (3,962 meters) of water, where much of the ocean floor is covered with foraminiferal ooze, made of the shells of marine foraminiferans. Below this depth there is less calcium carbonate, and the falling shelled organisms begin to dissolve while settling or soon after coming to rest on the bottom. The depth of water below which calcium carbonate begins to dissolve is called the calcium carbonate compensation depth. Calcium carbonates are the most abundant biological sediments on the seafloor; oozes of silica, however, are formed below the compensation depth.

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. What do the proper names or numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Most clastic sediment rock is first deposited on the continental shelf, mainly in tidal environments, in deltas, and along beaches.
2. Winds and currents carry coarse-grained particles offshore where they ultimately settle to the ocean floor.
3. Deposits of the rise and abyssal plain consisting of graded beds of sand, silt, and clay that have formed in this way are called foraminiferans .
4. Most of the near-shore and shallow-water sediments are calcareous .
5. Some of the larger contributors include clams, mussels, oysters, scallops, snails, and slugs.
6. Deep-land deposits are located in less than 13,000 feet (3,962 meters) of water, where much of the ocean floor is covered with foraminiferal ooze, made of the shells of marine foraminiferans.

7. Calcium carbonates are the most abundant chemical sediments on the seafloor; oozes of silica, however, are formed below the compensation depth.

Exercise 4. Answer the following questions:

1. Where is most clastic sediment—rock and soil eroded from the land— first deposited?
2. What do winds and currents carry?
3. How are deposits of the rise and abyssal plain consisting of graded beds of sand, silt, and clay called?
4. How are most of the near-shore and shallow-water sediments called?
5. What do some of the larger contributors include?
6. Where are deep-sea deposits located?
7. What are calcium carbonates?

Exercise 5. Match the word with its definition.

1. clastic	a. a solid substance found in nature as limestone and marble and in plant ashes, bones, and shells and used especially in making lime and portland cement
2. soil	b. an earthy material that is sticky and easily molded when wet and hard when baked
3. particle	c. any of various edible saltwater mollusks with a long dark hinged double shell
4. abyssal	d. any of numerous edible marine mollusks that have two hinged shells and live in sand or mud
5. clay	e. a very small quantity or piece
6. clam	f. any of various marine mollusks that include important edible shellfish and have a rough uneven shell made up of two hinged parts and closed by a single muscle
7. mussel	g. any of numerous long wormlike land mollusks that are related to the snails but have only an underdeveloped shell or none at all
8. oyster	h. soft mud or slime (as on the bottom of a lake)
9. scollop	i. of or relating to the bottom waters of the ocean depths
10. slug	j. the loose surface material of the earth in which plants grow
11. ooze	
12. calcium carbonate	

(adopted from»Earth.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Unit 7. Environmental Geology

Part 1

Exercise 1. Fill in the gaps with the words from the box. Read the whole paragraph.

threats hosting increasing minerals leaders movement specimen activists grew out

The environmental (1) …of the late 20th century (2) … of the 1960s and 1970s, a time of (3) … awareness of human (4) … to the natural world. Scientists warned world (5) … and the public about acid rain and toxic waste, while environmental (6) … promoted global awareness by (7) … the first Earth Day in 1970.

Exercise 2. Put the sentences into the proper order. Read the whole paragraph.

a. It was not until the late 1980s and early 1990s, however, that environmental issues took center stage in the United States.
b. Efforts to recycle, or reuse, products such as paper, aluminum, and plastic gained popularity on the individual, corporate, and government levels.
c. Environmental disasters, such as the Bhopal gas leak and the Chernobyl nuclear power plant explosion had happened.
d. Many local and national environmental groups were founded, including the Student Environmental Action Coalition and the Rainforest Action Network.
e. They also urged legislators and lay people to become more concerned for the world around them.
f. The new wave of environmental activism called upon everyday people to recognize and take responsibility for the impact of their daily activities on the world around them.
g. Many states set up special departments to assist local communities in their recycling efforts.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. During / attention / global / this period / increasing / the so-called / gained / «green movement».
2. Recognizing / in 1996 / the need for / in Moscow / collective action / met for a summit / to solve environmental problems / the leaders of / the Group of Seven / seven major industrialized nations .
3. Although / Russia's outdated nuclear plants / some activists / the problem of / criticized / and / the meeting for falling short of / nuclear-weapons testing / expectations / on the topic of / did open discussion / the summit .
4. In the years / agenda / following / diplomatic / environmental issues / part of the / remained / an important / the meeting .

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word or phrase with its definition.

1. awareness	a. relating to, or applying to the whole of something (as a computer program)
2. acid rain	b. to process (as liquid body waste, glass, or cans) in order to regain materials for human use
3. toxic waste	c. something used to defeat, or destroy relating to, or being a nucleus
4. global	d. any of numerous synthetic or processed materials that can be formed into objects, films, or fibers
5. to recycle	e. having or showing understanding or knowledge : consciousness
6. department	f. rain with increased acidity that is caused by environmental factors (as atmospheric pollutants)
7. summit	g. material left over, rejected, or thrown away caused by a poison or toxin
8. aluminium	h. a looking forward to or waiting for something
9. plastic	i. a list of items of business to be considered (as at a meeting) relating to, or concerned with diplomacy or diplomat
10. expectation	j. the highest level of officials ; esp: the diplomatic level of heads of government
11. nuclear weapon	
12. diplomatic agenda	

(adopted from «Environmentalism goes global.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2

Environmental and urban geology

This relatively new field involves the collection and analysis of geological data and their application to problems created by human use of the environment. One aspect of this branch of geology is called urban geology. It is concerned with the application of engineering geology to environmental problems of cities, especially large metropolitan areas. Environmental and urban geology deal with those aspects of geology that directly influence people's use of land. The scope of environmental geology is so broad that it includes areas of related interest in the physical, biological, and social sciences. Because of its interdisciplinary focus, it draws heavily on such geological sciences as engineering geology, economic geology, geomorphology, and sedimentology.

Sedimentology. Also referred to as sedimentary geology, this study of sedimentary deposits and their origins deals with ancient and recent marine and terrestrial deposits and their animals, plants, minerals, textures, and evolution in time and space.

Geomorphology. Meaning «form and development of the Earth,» geomorphology involves the attempt to derive a working model for the outer part of the Earth.

Economic geology. Sometimes referred to as geological engineering, economic geology links mining and civil engineering. It involves the application of geological principles to the study of soil, rock materials, and groundwater as they affect the planning, design, location, construction, operation, and maintenance of engineering structures.

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

sedimentology geomorphology economic geology acid rain toxic waste

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. This relatively new field involves the collection and analysis of chemical data and their application to problems created by human use of the environment.
2. Environmental and urban geology deal with those aspects of geology that directly influence people's use of land.
3. The scope of environmental geology is so broad that it includes areas of related interest in the physical, biological, and social sciences .
4. Geomorphology deals with ancient and recent marine and terrestrial deposits and their animals, plants, minerals, textures, and evolution in time and space.
5. Sedimentology involves the attempt to derive a working model for the outer part of the Earth.
6. Environmental and urban geology link mining and civil engineering .
7. Economic geology involves the application of geological principles to the study of soil, rock materials, and groundwater as they affect the planning, design, location, construction, operation, and maintenance of engineering structures.

Exercise 4. Answer the following questions:

1. What does this relatively new field involve?
2. What do environmental and urban geology deal with?
3. What does the scope of environmental geology include?
4. What does sedimentology deal with?
5. The attempt of what does geomorphology involve?

6. What is economic geology?
7. What does economic geology link?

Exercise 5. Match the word or phrase with its definition.

1. application	a. facts about something that can be used in calculating, reasoning, or planning
2. environment	b. something built or put together
3. urban	c. an accumulation of mineral matter in nature relating to the sea
4. marine deposit	d. of, relating to, typical of, or being a city
5. terrestrial deposit	e. ability to be put to practical use
6. groundwater	f. the whole complex of factors (as soil, climate, and living things) that influence the form and the ability to survive of a plant or animal or ecological community
7. planning	g. an accumulation of mineral matter in nature relating to the earth or its living things
8. data	h. the act, process, method, or result of operating
9. construction	i. water within the earth that supplies wells and springs
10. operation	j. the act of maintaining : the state of being maintained
11. location	
12. maintenance	

(adopted from «geology.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 3

Environmental disasters take tolls but raise awareness

of the most serious challenges to the environment occurred in the last few decades of the 20th century, catalyzing environmental concern around the globe.

The most common environmental disasters were massive oil spills. The first major modern spill took place in 1967, when the tanker Torrey Canyon went aground near England and spilled about 30,000 tons of oil into the sea. More recently, the United States faced the worst oil spill in its history when the tanker Exxon Valdez ran aground in Prince William Sound, Alaska, dumping 200,000 barrels of oil into the water. More than a thousand miles of coastline were covered with oil, killing thousands of fish, birds, and other wildlife.

Nuclear power plants also were the stages for several environmental disasters. In 1979, an accident at the Three Mile Island nuclear power plant near Harrisburg, Pa., caused some radioactive gas to enter the atmosphere. More than 144,000 people were evacuated but, fortunately, a major tragedy was averted. In 1986, the worst accident in nuclear power history occurred at a nuclear plant in Chernobyl, in what is now independent Ukraine. During that incident, radioactive material poured into the atmosphere, killing 30 people.

The disaster with the highest human toll occurred in 1984, when about 50 tons of methyl isocyanate leaked into the air from a pesticide company in Bhopal, India. An estimated 2,500 people were killed.

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. What do the proper names or numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Some of the most serious challenges to the environment occurred in the last few decades of the 19th century, catalyzing environmental concern around the globe.
2. The most common environmental disasters were massive oil spills.
3. The second major modern spill took place in 1967, when the tanker Torrey Canyon went aground near England and spilled about 30,000 tons of oil into the sea.
4. More than a thousand miles of coastline were covered with oil, killing thousands of fish, birds, and other wildlife.
5. Nuclear power plants also were the stages for several environmental disasters.
6. In 1988, the worst accident in nuclear power history occurred at a nuclear plant in Chernobyl, in what is now independent Ukraine.
7. During that incident, radioactive material poured into the atmosphere, killing 30 people.

Exercise 4. Answer the following questions:

1. When did some of the most serious challenges to the environment occur?
2. What were the most common environmental disasters?
3. When did the first major modern spill take place?
4. What was the worst oil spill in the history of the United States?
5. What also were the stages for several environmental disasters?
6. What accident occurred in 1979?
7. When did the disaster with the highest human toll occur in India?

Exercise 5. Match the word or phrase with its definition.

1. challenge	a. a round bulging container that is longer than it is wide and has flat ends
2. coastline	b. a fluid (as hydrogen or air) that has no fixed shape and tends to expand without limit caused by, or exhibiting radioactivity
3. barrel	c. chemical group consisting of carbon and hydrogen
4. wildlife	d. to remove troops or people from a place of danger
5. accident	e. a sudden great misfortune ; esp: something (as a flood or tornado) that happens suddenly and causes much suffering or loss
6. radioactive gas	f. the outline or shape of a coast
7. oil spill	g. the whole mass of air surrounding the earth
8. to evacuate	h. a substance used to destroy pests
9. disaster	i. nonhuman living things and especially wild animals living in their natural environment
10. atmosphere	j. an unintended and usually sudden and unexpected event resulting in loss or injury
11. pesticide	
12. methyl	

(adopted from «Environmental disasters take tolls but raise awareness.» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

4. READING ROOM FOR STUDENTS OF MECHANICS AND MATHEMATICS

Unit 1. Math History

Part 1

Exercise 1. Fill in the gaps with the words from the box.

to solve	ancient	learned	calculations	various	prehistoric	known
equal	involved					

(1)… humans probably learned to count at least up to ten on their fingers. The ancient Egyptians (3rd millenium BC), Sumerians (2000-1500 BC), and Chinese (1500 BC) had systems for writing down numbers and could perform (2)… using various types of abacus. They used some fractions. Mathematicians in (3)… Egypt could solve simple problems which (4)… finding a quantity that satisfied a given linear relationship. Sumerian mathematicians knew how (5)… problems that involved quadratic equations. The fact that, in a right-angled triangle, the square of the longest side is (6)… to the sum of the squares of the other two sides (Pythagoras' theorem) was (7)… in various forms in these cultures and also in Vedic India (1500 BC).

Exercise 2. Put the sentences into the proper order and read the whole paragraph.

a. His disciple Pythagoras established geometry as a recognized science among the Greeks.
b. Undoubtedly the impetus for this demand for logical proof came from the discovery by this group of the surprising fact that the square root of 2 is a number which cannot be expressed as the ratio of two whole numbers.
c. Pythagoras began to insist that mathematical statements must be proved using a logical chain of reasoning starting from acceptable assumptions.
d. The first theoretical mathematician is held to be Thales of Miletus (c. 580 BC) who is believed to have proposed the first theorems in plane geometry.

e. The use of logical reasoning, the methods of which were summarized by Aristotle, enabled Greek mathematicians to make general statements instead of merely solving individual problems as earlier mathematicians had done.

Exercise 3. Put the words and phrases of the given sentences into the proper order.

1. of its most lasting achievements / The spirit / the Elements by Euclid / is typified in one / of Greek mathematics /.
2. from a handful / is logically deduced / This is a complete / of simple assumptions / in which the entire subject / treatise on geometry /.
3. lacked a simple notation / always relied on / The ancient Greeks / expressing problems / for numbers and nearly / geometrically /.
4. Although the Greeks / they never developed / with their geometrical methods / of equations or any / were extremely successful / algebraic ideas of structure / a general theory /.
5. However they made / Diophantus of Alexandria / techniques for solving / equations and these techniques / particular kinds of / were summarized by / considerable advances in /.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word and its definition.

1. quantity	a. a flat shape with three straight sides and three angles, one of which is a 90°
2. at least	b. an influence that makes something happen or makes it happen more quickly
3. millennium	c. a sum, a number
4. abacus	d. a frame with small balls that can be slid along on thick wires, used for counting and calculating
5. a right-angled triangle	e. the study of lines, shapes etc that are two-dimensional
6. mechanics	f. something important that you succeed in doing by your own effort
7. plane geometry	g. at or in the lowest degree
8. assumption	h. to say firmly and often that something is true, especially when other people think it may not be true
9. disciple	i. a period of 1000 years

10. insist	j. someone who believes in the ideas of a great teacher or leader
11. impetus	
12. achievement	

(adopted from «mathematics» The Hutchinson Educational encyclopedia on CD-ROM, 1999)

Part 2

Medieval period

When the Hellenic civilization declined, Greek mathematics (and the rest of Greek science) was kept alive by the Arabs, especially in the scientific academy at the court of the caliphs of Baghdad. The Arabs also learned of the considerable scientific achievements of the Indians, including the invention of a system of numerals (now called `arabic´ numerals) which could be used to write down calculations instead of having to resort to an abacus.

One mathematician can be singled out as a bridge between the ancient and medieval worlds: al-Khwarizmi summarized Greek and Indian methods for solving equations and wrote the first treatise on the Indian numerals and calculating with them. Al-Khwarizmi's books and other Arabic works were translated into Latin and interest in mathematics in Western Europe began to increase in the 12th century.

It was the demands of commerce which gave the major impetus to mathematical development and north Italy, the centre of trade at the time, produced a succession of important mathematicians beginning with Italian mathematician Leonardo Fibonacci who introduced Arabic numerals. The Italians made considerable advances in elementary arithmetic which was needed for money-changing and for the technique of double-entry bookkeeping invented in Venice. Italian mathematicians began to express equations in symbols instead of words. This algebraic notation made it possible to shift attention from solving individual equations to investigating the relationship between equations and their solutions, and led eventually to the discovery of methods of solving cubic equations (about 1515) and quartic equations. They began to use the square roots of negative numbers (complex numbers) in their solutions to equations.
(adopted from «mathematics» The Hutchinson Educational encyclopedia on CD-ROM, 1999)

Exercise 1. Look through the text and define which of the following key words are mentioned in it and put them in the order they appear.

calculus system of numerals theory of statistics symbols mathematical development

Exercise 2. Are the following statements true or false?

1. The Arabs also invented system of numerals.
2. Al-Khwarizmi can be singled out as a bridge between the medieval and modern worlds.
3. Al-Khwarizmi's books and other Arabic works were translated into Latin.
4. The Italians were the first to express equations in symbols instead of words.
5. Al-Khwarizmi introduced Arabic numerals.
6. Using in equations symbols instead of words made it possible to shift attention from solving individual equations to investigating the relationship between equations and their solutions.
7. Methods of solving cubic equations were discovered in the 15th century.

Exercise 3. Answer the following questions:

1. Who kept alive Greek mathematics when the Hellenic civilization declined?
2. What did the Arabs learn from the Indians?
3. What is al-Khwarizmi famous for?
4. When did the interest in mathematics in Western Europe begin to increase?
5. What gave the major impetus to mathematical development?
6. Who introduced Arabic numerals?
7. Where was the technique of double-entry bookkeeping invented?

Exercise 4. Match the word and its definition.

1.	considerable	a.	to find an answer to (a problem etc.)
2.	abacus	b.	stimulus
3.	solve	c.	the quantity that, multiplied by itself, will produce the given quantity
4.	double entry book-keeping	d.	an apparatus made of beads sliding on wires for facilitating arithmetical calculations
5.	increase	e.	a literary composition expounding, discussing, and illustrating some particular subject in a thorough way
6.	treatise	f.	important
7.	demand	g.	as an alternative or substitute
8.	square root	h.	a method of book-keeping in which every transaction is entered twice, once on the credit side of the account that gives, and once on the debit side of the account that receives

9. succession — i. a system of signs, figures etc., employed in any science or art
10. impetus — j. an authoritative claim or request
11. notation
12. instead

Part 3

Modern period

In the 17th century the focus of mathematical activity moved to France and Britain though continuing with the major themes of Italian mathematics: improvements in methods of calculation, development of algebraic symbolism, and the development of mathematical methods for use in physics and astronomy. Geometry was revitalized by the invention of coordinate geometry by René Descartes 1637; Blaise Pascal and Pierre de Fermat developed probability theory; John Napier invented logarithms; and Isaac Newton and Gottfried Leibniz invented calculus, later put on a more rigorous footing by Augustin Cauchy. In Russia, Nikolai Lobachevsky rejected Euclid's parallelism and developed a non-Euclidean geometry ; this was subsequently generalized by Bernhard Riemann and later utilized by Einstein in his theory of relativity. In the mid-19th century a new major theme emerged: investigation of the logical foundations of mathematics. George Boole showed how logical arguments could be expressed in algebraic symbolism. Friedrich Frege and Giuseppe Peano considerably developed this symbolic logic.

In the 20th century, mathematics has become much more diversified. Each specialist subject is being studied in far greater depth and advanced work in some fields may be unintelligible to researchers in other fields. Mathematicians working in universities have had the economic freedom to pursue the subject for its own sake. Nevertheless, new branches of mathematics have been developed which are of great practical importance and which have basic ideas simple enough to be taught in secondary schools. Probably the most important of these is the mathematical theory of statistics in which much pioneering work was done by Karl Pearson. Another new development is operations research, which is concerned with finding optimum courses of action in practical situations, particularly in economics and management. As in the late medieval period, commerce began to emerge again as a major impetus for the development of mathematics.

Higher mathematics has a powerful tool in the high-speed electronic computer, which can create and manipulate mathematical `models´ of various systems in science, technology, and commerce.

Modern additions to school syllabuses such as sets, group theory, matrices, and graph theory are sometimes referred to as `new´ or ` modern´ mathematics.

Traditionally the subject of mathematics is divided into arithmetic , which studies numbers, geometry, which studies space, algebra, which studies structures, analysis, which studies infinite processes (in particular, calculus), and probability theory and statistics, which study random processes.

(adopted from «mathematics» The Hutchinson Educational encyclopedia on CD-ROM, 1999)

Exercise 1. Look through the text and define which of the following key words are mentioned in it and put them in the order they appear.

relationship between equations   new branches of mathematics   practical importance of math   solving equations   symbolism

Exercise 2. Are the following statements true or false?

1. In the 17th century the focus of mathematical activity moved to France and Italy.
2. Blaise Pascal invented logarithms.
3. Nikolai Lobachevsky developed a non-Euclidean geometry in Russia.
4. George Boole showed how logical arguments could be expressed in theory of relativity.
5. In the 20th century new branches of mathematics which are of great practical importance have been developed.
6. Karl Pearson developed mathematical theory of statistics.
7. Computers help to create and manipulate mathematical `models´ of various systems in science, technology, and commerce.

Exercise 3. Answer the following questions:

1. When was coordinate geometry invented?
2. Who developed probability theory?
3. What did Augustin Cauchy study?
4. Who developed a non-Euclidean geometry in Russia?
5. When did investigation of the logical foundations of mathematics begin?
6. What were the most important achievements in math of the 20th century?
7. What subjects is mathematics traditionally divided into?

Exercise 4. Match the word and its definition.

1. major — a. to put new strength or power into something
2. logarithm — b. the best or most suitable for a particular purpose or in a particular situation
3. revitalize — c. to use something for a particular purpose
4. rigorous — d. having very serious or worrying results
5. reject — e. a plan that states exactly what students at a school or college should learn in a particular subject

6. utilize	f. serious study of a subject, in order to discover new facts or test new ideas
7. unintelligible	g. to refuse to accept, believe in, or agree with something
8. pursue	h. impossible to understand
9. research	i. careful, thorough, and exact
10. optimum	j. to continue doing an activity or trying to achieve something over a long period of time
11. emerge	
12. syllabus	

Unit 2. Numeration System and Numbers

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. Hence it is also known as the Hindu-Arabic system.
b. The ancient Hindus are credited with discovering the decimal system of numeration we use today.
c. Gradually, however, the superior Hindu-Arabic system was learned by the Europeans, and eventually it replaced the Roman system.
d. Adoption of the Hindu-Arabic system met resistance due to the widespread use of the Roman numeral system during this period.
e. This system was translated into Arabic prior to its introduction into Europe by traveling merchants around the 13th century.

Exercise 2. Fill in the gaps with the words from the box.

capital wrote subtracted dominant written large denote row added

The Roman numeral system, in which letters represent numbers, was (1)… in Europe for nearly 2,000 years. Seven letters (2)… numbers in the Roman system: I = 1; V = 5; X = 10; L = 50; C = 100; D = 500; and M = 1,000. Either (3)… or small letters may be used. Repeating a symbol repeats its value: II=2. A symbol is not used more than three times in a (4)…: III=3. When a symbol of lesser value follows one of greater value, the two are (5)…: VI=6. When a symbol of lesser value is placed before one of greater value, the lesser value is (6)…: IV=4, XC=90, CD=400. Numbers involving 4 or 9 are always (7)… by placing a symbol of lesser value before one of greater value: 24=XXIV.

Exercise 3. Put the words and phrases of the given sentences into the proper order.

1. indicate dates / Today Roman numerals / and to organize / are used to / outlines / on monuments and cornerstones /.
2. books and / They also may number / clocks and watches / the introductory pages of / the hours on /.
3. does not provide / The Roman system / are not based on / an efficient and easy / method of computation / the principle of position / like others that /.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word and its definition.

1. decimal system	a. scattered or found over a wide area
2. merchant	b. at some later time : in the end
3. widespread	c. capable of producing desired results especially without waste (as of time or energy)
4. superior	d. a buyer and seller of goods for profit
5. eventually	e. to make, do, or perform again
6. replace	f. a system of numbers that uses a base of 10
7. dominant	g. commanding, controlling, or having great influence over all others
8. row	h. point out : indicate
9. denote	i. to put something new in the place of
10. repeat	j. excellent of its kind : better
11. provide	
12. efficient	

(adopted from «numeration systems and numbers.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Number

Number is a symbol used in counting or measuring. In mathematics, there are various kinds of numbers. The everyday number system is the decimal ('proceeding by tens') system, using the base ten. Real numbers include all rational numbers (integers, or whole numbers, and fractions) and irrational numbers (those not expressible as fractions). Complex numbers include the real and imaginary numbers (real-number multiples of the square root of -1). The binary number system, used in computers, has two as its base. The natural numbers, 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9, give a counting system that, in the decimal system, continues 10, 11, 12, 13, and so on. These are whole numbers (integers), with fractions represented as, for example, 1 / 4, 1 / 2, 3 / 4, or as decimal fractions (0.25, 0.5, 0.75). They are also rational numbers. Irrational numbers cannot be represented in this way and require symbols, such as √2, p, and e. They can be expressed numerically only as the (inexact) approximations 1.414, 3.142, and 2.718 (to three places of decimals) respectively. The symbols p and e are also examples of transcendental numbers, because they (unlike √2) cannot be derived by solving a polynomial equation (an equation with one variable quantity) with rational coefficients (multiplying factors). Complex numbers, which include the real numbers as well as imaginary numbers, take the general form a + bi, where i = √-1 (that is, i2 = -1), and a is the real part and bi the imaginary part.

The ancient Egyptians, Greeks, Romans, and Babylonians all evolved number systems, although none had a zero, which was introduced from India by way of Arab mathematicians in about the 8th century AD and allowed a place-value system to be devised on which the decimal system is based. Other number systems have since evolved and have found applications. For example, numbers to base two (binary numbers), using only 0 and 1, are commonly used in digital computers to represent the two-state 'on' or 'off' pulses of electricity. Binary numbers were first developed by German mathematician Gottfried Leibniz in the late 17th century.

(adopted from «number» The Hutchinson Educational encyclopedia on CD-ROM, 1999)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. In what context are the proper names and numerals from Exercise 1. mentioned?

Exercise 3. Are the following statements true or false?

1. There are many kinds of numbers in mathematics.
2. The everyday number system is the binary system.
3. √2, p, and e are rational numbers.
4. Complex number is a number consisting of a real and an imaginary component.
5. A zero was introduced from India by way of Arab mathematicians.
6. Binary numbers were first developed by ancient Egyptians.
7. Whole numbers are also called integers.

Exercise 4. Answer the following questions:

1. What kinds of numbers do you know?
2. What numbers do real numbers include?
3. What numbers can be expressed numerically only as the approximations?
4. What numbers include the real and imaginary component?
5. When was a zero introduced?
6. Where is the binary number system used?
7. Who first developed binary numbers?

Exercise 5. Match the word and its definition.

1. equal	a. the part of a fraction that is below the line
2. integer	b. to leave out
3. denominator	c. identical in mathematical value
4. numerator	d. a number that represents a number of equal parts of a whole or the division of one number by another
5. omit	e. not capable of being produced by the fundamental operations of algebra, addition, multiplication etc.
6. include	f. two algebraic expressions equal to one another, and connected by the sign =
7. fraction	g. a whole number
8. transcendental	h. the part of a fraction that is above the line
9. imaginary	i. not real
10. various	j. to receive or obtain from a source
11. derive	
12. equation	

Part 3

More than 5,000 years ago an Egyptian ruler recorded, perhaps with a bit of exaggeration, the capture of 120,000 prisoners, 400,000 oxen, and 1,422,000 goats. This event was inscribed on a ceremonial mace which now is in a museum in Oxford, England.

The ancient Egyptians developed the art of counting to a high degree, but their system of numeration was very crude. For example, the number 1,000 was symbolized by a picture of a lotus flower, and the number 2,000 was symbolized by a picture of two lotus flowers growing out of a bush. Although these symbols, called hieroglyphics, permitted the Egyptians to write large numbers, the numeration system was clumsy and awkward to work with. The number 999, for instance, required 27 individual marks.

In our system of numeration, we use ten symbols called digits—0, 1, 2, 3, 4, 5, 6, 7, 8, and 9—and combinations of these symbols. Our system of numeration is called the decimal, or base-ten, system. There is little doubt that our ten fingers influenced the development of a numeration system based on ten digits.

Other numeration systems were developed in early cultures and societies. Two of the most common were the base-five system, related to the number of fingers on one hand, and the base-twenty system, related to the number of fingers and toes.

In some languages the word for five is the same as the word for hand, and the word for ten is the same as the word for two hands. In our own language the word digit is a synonym for the word finger—that is, ten digits, ten fingers.

Still another early system of numeration was a base-sixty system developed by the Mesopotamians and used for centuries. These ancient people divided the year into 360 days (6×60); today we still divide the hour into 60 minutes and the minute into 60 seconds. Numeration systems of current interest include a binary, or base-two, system used in electronic computers and a base-twelve, or duodecimal, system.

(adopted from «numeration systems and numbers.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. In what context are the proper names and numerals from Exercise 1. mentioned?

Exercise 3. Are the following statements true or false?

1. Egyptian system of numeration was very crude.
2. The ancient Egyptians symbolized the number 1,000 by a picture of a rose.
3. Our system of numeration is called the decimal system.
4. The decimal system is based on nine digits.
5. The base-five numeration system is related to the number of fingers on one hand.
6. In English the word digit is a synonym for the word finger.
7. The Mesopotamians developed a base-six numeration system.

Exercise 4. Answer the following questions:

1. What was inscribed on a ceremonial mace which now is in a museum in Oxford, England?
2. What system of numeration used hieroglyphics?
3. What number did the ancient Egyptians symbolize by a picture of two lotus flowers growing out of a bush?
4. How many individual marks did the number 999 require in Egyptian system of numeration
5. How is our system of numeration called?
6. What else numeration systems do you know?
7. What numeration systems is used in electronic computers?

Exercise 5. Read the text and give the title to it.

Exercise 6. Match the word and its definition.

1. inscribe	a. planned or done in a rough or unskilled way
2. mace	b. now passing; occurring in or belonging to the present time
3. crude	c. difficult to use or handle
4. permit	d. to write, engrave, or print something on or in
5. clumsy	e. lacking skill or grace in movement
6. awkward	f. to take in or have as part of a whole or group
7. relate	g. to make possible ; give an opportUnit y
8. synonym	h. a letter, character, or sign used instead of a word or group of words
9. current	i. an ornamental staff carried as a symbol of authority
10. include	j. to have relationship or connection
11. digit	
12. symbol	

Unit 3. Arithmetic Operations

Part 1

Exercise 1. Put the words and phrases of the given sentences into the proper order.

1. practical problems / or quantities / Arithmetic / to help people / evolved as a tool / involving numbers / solve /.
2. different kinds of / people had to / Because they / of number problems / had to solve / develop several / number operations / several different kinds /.
3. to get / a method of / In arithmetic / a third / refers to / combining two / the word operation / numbers /.

Exercise 2. Fill in the gaps with the words from the box.

counting much find compared discovered many subtraction addition combining

The process of (1)…two or more numbers to (2)… the quantity represented by them altogether is called addition. Because addition is so closely related to (3)…, it was probably the first arithmetic operation that man (4)….
Although many people choose to think of subtraction as a separate and distinct arithmetic process, it is not. Subtraction is just the reverse of (5)…. Subtraction

answers both kinds of questions. When a number of things are taken away, subtraction answers how (6)… things are left. And if two quantities are being (7)…, subtraction answers how many more are needed to make them equal or what the difference is between the two.

Exercise 3. Put the sentences into the proper order and read the whole paragraph.

1. One of the earliest multiplication techniques was called doubling or duplation.
2. Ancient mathematicians developed multiplication to simplify repeated addition problems.
3. Division is the opposite of multiplication—multiplication is a shortened method of adding, and division is a shortened method of subtracting.
4. Addition is just a shortcut method of counting, but even addition can be time-consuming, especially when the same number must be added repeatedly.
5. It is a mechanical method of manipulating numbers which can be used to calculate the sum of large numbers but only requires two digits to be multiplied at a time.
6. The multiplication technique used today is faster than doubling.
7. While multiplication combines numbers to obtain sums, division separates numbers into equal parts.
8. When people learned to add, they had developed a timesaving device.
9. In order to multiply quickly it is necessary only to memorize all the possible multiplications of two digits, from 1×1=1 to 9×9=81.
10. These are called multiplication facts or the multiplication table.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word and its definition.

1.	evolve	a. a way, plan, or procedure for doing something
2.	solve	b. a piece of equipment to serve a special purpose
3.	practical	c. to find a solution for
4.	method	d. to have relationship or connection
5.	relate	e. to develop or work out from something else
6.	separate	f. having independent existence
7.	distinct	g. for the purpose of
8.	doubling	h. real and different from each other
9.	reverse	i. opposite or contrary to a previous or normal condition
10.	device	j. the whole amount
11.	sum	
12.	in order	

(adopted from «arithmetic.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

The Beginnings of Arithmetic

The foundation of all other branches of mathematics is arithmetic, the science of calculating with numbers. Without the ability to use numbers, it would not be possible to measure distance or tell time. People would not be able to figure out how many gallons per mile they get with an automobile; they would not be able to judge how tall they are or how high a building is; they could not buy something in a store and figure out if they got the correct change in return. All of the simple operations done with numbers would be virtually impossible without arithmetic: it is one of the most useful of all sciences.

Arithmetic is also one of the most fundamental sciences. It includes six basic operations for calculating with numbers: addition, subtraction, multiplication, division, involution (raising to powers), and evolution (finding roots).

These operations are used in all other branches of mathematics; without arithmetic, geometry, algebra, and calculus would not be possible.

The term arithmetic comes from arithmos, the Greek word for number; but people began doing arithmetic long before the Greeks invented the word, even before anyone invented numbers. Historians believe that as early as 10,000 years ago, when prehistoric people started farming, they began to use arithmetic. They needed to know such things as how many sheep they owned, or how many rows of grain they planted, or how long it would be before harvest season arrived.

According to historians, prehistoric farmers devised an ingenious method for keeping track of things; they used a process of matching that mathematicians call one-to-one correspondence. A shepherd, for example, could keep track of his flock by dropping a pebble into a pile or by cutting a notch in a twig for every sheep that went to pasture in the morning. He could make sure that all his sheep returned home by matching them, one by one, to the pebbles in his pile or the notches on his twig. This process of matching pebbles or notches with objects was the first step in the development of arithmetic.

(adopted from «arithmetic.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it and put them in the order they appear.

useful science positive integers calculating with numbers fraction matching

Exercise 2. Are the following statements true or false?

1. Arithmetic is the foundation of all other branches of mathematics.
2. Arithmetic includes five basic operations for calculating with numbers.
3. Involution is finding roots.
4. The term arithmetic is of Greek origin.

5. More than 100,000 years ago, when prehistoric people started farming, they began to use arithmetic.
6. Prehistoric farmers used abacus for keeping track of things.
7. The process of matching pebbles or notches with objects was the first step in the development of arithmetic.

Exercise 3. Answer the following questions:
1. What is the foundation of all branches of mathematics?
2. Why is arithmetic one of the most useful of all sciences?
3. How many basic operations for calculating with numbers do you know?
4. In which branches of mathematics are the basic arithmetic operations used?
5. When did prehistoric people begin to use arithmetic?
6. Why did prehistoric people need arithmetic?
7. What did prehistoric farmers invent for keeping track of things?

Exercise 4. Match the word and its definition.

1. impossible	a. a small rounded stone
2. measure	b. to find out the size, extent, or amount of
3. figure out	c. to hold as an opinion: think
4. ingenious	d. a branch of higher mathematics concerned especially with rates of change and the finding of lengths, areas, and volumes
5. judge	e. a great amount
6. calculus	f. find out, discover
7. algebra	g. incapable of being or of occurring
8. believe	h. to form an opinion after careful consideration
9. prehistoric	i. to have or hold as property: possess
10. own	j. relating to, or existing in times before written history
11. pebble	
12. pile	

Part 3
Counting

It is just a short step from one-to-one correspondence to counting, which is the process of matching objects with the names of numbers. Counting is the second simplest arithmetic process. The earliest mathematicians, thousands of years ago, probably learned to count in much the same way as little children do today—with their fingers.

It is not just coincidence that the Latin word for finger is digitus and that the ten numerals used in writing numbers (0, 1, 2, 3, 4, 5, 6, 7, 8, and 9) are often called digits. The names that people invented for numbers came directly from counting. Most modern languages, including English, have base ten number systems—that is, they have separate number names only for the first ten numbers, corresponding to the ten fingers used for counting. Beyond ten the cycle of number names begins all over again. For example, in English the word eleven comes from the Old English word endleofan, which means «one left over.» Twelve is from the word twelf, meaning «two left over.» Thirteen is clearly a version of «three and ten,» and twenty comes from the Old English word twentizh, which means «two tens.»

The numbers that are used for counting—one, two, three, four, and so on—make up a special class of numbers and are referred to as a class by several different terms. They are called counting numbers, whole numbers, or positive integers (from the Latin word integer, meaning «whole»). They are also referred to as natural numbers because they were the first kinds of numbers that occurred to people, and for a long time they were the only numbers that anyone used.

All the laws of arithmetic are based upon these counting, or whole, numbers. When people learn to add, subtract, multiply, divide, raise to powers, and extract roots, they are learning to calculate with whole numbers. Other kinds of numbers, such as fractions, negative integers, and zero were not introduced until much later, when it was realized that new kinds of numbers were needed to make all the operations of arithmetic possible.

(adopted from «arithmetic.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it and put them in the order they appear.

arithmetic process positive integers counting natural number digit

Exercise 2. Are the following statements true or false?
1. Counting is one of the simplest arithmetic process.
2. Counting is the process of matching objects with the names of numbers.
3. Latin word for numeral is digitus.
4. Most modern languages, including English, have base ten number systems.
5. The numbers that are used for counting are called counting numbers, whole numbers, or positive integers.
6. Zero was introduced earlier than positive integers.
7. Counting numbers are also called natural numbers because they are the only kind of numbers that occurred to people.

Exercise 3. Answer the following questions:

1. How are the ten numerals (0, 1, 2, 3, 4, 5, 6, 7, 8, and 9) connected with the fingers?
2. What does the word thirteen come from?
3. Which number means «two tens»?
4. What does the Latin word integer mean?
5. What were the first kinds of numbers that occurred to people?
6. With what numbers do people learn to calculate?
7. When were other kinds of numbers, such as fractions, negative integers, and zero introduced?

Exercise 4. Match the word and its definition.

1. coincidence	a. to take in or have as part of a whole or group
2. count	b. a symbol or group of symbols representing a number
3. term	c. a rule or principle stating something that always works in the same way under the same conditions
4. law	d. to find by performing mathematical operations (as addition, subtraction, multiplication, and division)
5. make up	e. a relation between sets in which each member of one set is matched to one or more members of the other set
6. include	f. two things that happen at the same time by accident but seem to have some connection
7. class	g. a word or expression that has an exact meaning in some uses or is limited to a particular field
8. calculate	h. compose
9. integer	i. a number that is a natural number (as 1, 2, or 3), the negative of a natural number, or 0 called also whole number
10. invent	j. to create or produce for the first time
11. numeral	
12. correspondence	

Unit 4. Algebra

Part 1

Exercise 1. Put the words and phrases of the given sentences into the proper order.

1. using symbols / the general properties / to represent variables / in which / usually letters / Branch of mathematics / of numbers / and unknown quantities / are studied by /.
2. one or more / is / An algebraic expression / a polynomial equation / variables (denoted by letters) / that has /.
3. mathematics / and Boolean algebra / Algebra / is used in / (the latter is used in working out the logic for computers) / for example, matrix algebra / many areas of /.

Exercise 2. Put the sentences into the proper order and read the whole paragraph.

1. But the symbols are capable of a more generalized and extended meaning than the figures used in arithmetic.
2. Any elements in brackets should always be calculated first, followed by multiplication, division, addition, and subtraction.
3. In ordinary algebra the same operations are carried on as in arithmetic.
4. Within an algebraic equation the separate calculations involved must be completed in a set order.
5. It facilitates calculation where the numerical values are not known, or are inconveniently large or small, or where it is desirable to keep them in an analysed form.

Exercise 3. Fill in the gaps with the words from the box.

known solved solution contain eliminate solving equations variables unknown

If there are two or more algebraic equations that (1)…two or more (2)… quantities that may have a unique solution they can be (3)…simultaneously. For example, in the case of two linear (4)…with two unknown variables, such as: (i) x + 3y = 6 and (ii) 3y -2x = 4 the solution will be those unique values of x and y that are valid for both equations. Linear simultaneous equations can be solved by using algebraic manipulation to (5)…one of the variables. For example, both sides of equation (i) could be multiplied by 2, which gives 2x + 6y = 12. This can be added to equation (ii) to get 9y = 16, which is easily solved: y = 16 / 9. The variable x can now be found by inserting the (6)…y value into either original equation and (7)…for x.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word and its definition.

1. expression	a. set or kept apart
2. figure	b. mathematical operation that takes two numbers and gives an answer equal to the sum of a column containing one of the numbers repeated the number of times of the other number

3.	facilitate	c.	the operation of deducting one number from another
4.	inconvenient	d.	a mathematical or logical symbol or a combination of symbols and signs representing a quantity or operation
5.	separate	f.	to get rid of
6.	addition	e.	an algebraic expression having two or more terms
7.	multiplication	g.	causing difficulty, discomfort, or annoyance
8.	subtraction	h.	to put or place in
9.	square	i.	the product of a number multiplied by itself
10.	eliminate	j .	to make easier
11.	insert		
12.	polynomial		

(adopted from «algebra» The Hutchinson Educational encyclopedia on CD-ROM, 1999)

Part 2

More than 3,500 years ago an Egyptian named Ahmes collected a set of mathematical problems and their solutions. Included were problems such as finding the number that satisfies the equation x(2 / 3 + 1 / 2 + 1 / 7 + 1)=37.

About 2,500 years ago the Greek mathematician Pythagoras started a religious-mathematical brotherhood. Its members were called Pythagoreans. Intensely interested in geometry, they classified numbers according to geometrical properties.

The famous Greek geometer Euclid discovered important properties of numbers through a study of geometry.

Diophantus, another famous early Greek mathematician, has been called the «father of algebra.» He treated algebra from a purely numerical point of view. He made a special study of certain types of equations that are today called Diophantine equations.

Our modern word algebra comes from the Arabic al-jabr, which appeared in the title of an algebra text written in about AD 825 by the Arab astronomer and mathematician al-Khwarizmi. The words algorism and algorithm are derived from his name.

Our algebra of real numbers developed through the centuries from considerations of problems in arithmetic. The study of the algebra of real numbers and the recent recognition of the fundamental importance of the basic principles have led to the development of what is now called modern algebra or abstract algebra.

One of the earliest pioneers in this direction was the French genius Évariste Galois (1811–32). Although he lived a tragic life and died in a foolish duel

at the age of 20, his work led to the development of the modern theory of groups and fields.

The concepts of modern algebra have been found to be extremely useful in other branches of mathematics, as well as in the physical and social sciences. A chemist may use modern algebra in a study of the structure of crystals; a physicist may use modern algebra in designing an electronic computer; a mathematician may use modern algebra in a study of logic.

(adopted from «algebra.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. In what context are the proper names and numerals from Exercise 1. mentioned?

Exercise 3. Are the following statements true or false?

1. More than 3,500 years ago an Arabian named Ahmes collected a set of mathematical problems and their solutions.
2. The Greek mathematician Pythagoras started a religious-mathematical brotherhood.
3. Euclid has been called the «father of algebra.»
4. The words algorism and algorithm are derived from al-Khwarizmi's name.
5. Évariste Galois developed the modern theory of groups and fields.
6. The concepts of modern algebra can not be used in other sciences except mathematics.
7. The word 'algebra' comes from the Greek al-jabr.

Exercise 4. Answer the following questions:

1. When did Ahmes collect a set of mathematical problems and their solutions?
2. Who were called Pythagoreans?
3. Who introduced the name (al-jabr) that became known as algebra?
4. How did Euclid discover important properties of numbers ?
5. What is Diophantus famous for?
6. When did Évariste Galois live?
7. Where may the concepts of modern algebra be used?

Exercise 5. Look through the text above and give the title to it.

Exercise 6. Match the word and its definition.

1.	solution	a.	an association of people for a particular purpose; the persons engaged in the same business or profession
2.	brotherhood	b.	to make true by fulfilling a condition

3.	classify	c.	acknowledgment of something done or given
4.	property	d.	to arrange in or assign to classes
5.	satisfy	e.	to deal with
6.	treat	f.	a special quality of something
7.	title	g.	a separate or subordinate division or part of a central system
8.	be derived from	h.	to come from a certain source or basis
9.	consideration	i.	an answer to a problem
10.	recognition	j.	the name given to something (as a book, song, or job) to identify or describe it
11.	concept		
12.	branch		

Part 3

'Algebra' was originally the name given to the study of equations. In the 9th century, the Arab mathematician Muhammad ibn-Musa al-Khwarizmi used the term al-jabr for the process of adding equal quantities to both sides of an equation. When his treatise was later translated into Latin, al-jabr became 'algebra' and the word was adopted as the name for the whole subject.

From ancient times until the Middle Ages, equation-solving depended on expressing everything in words or in geometric terms. It was not until the 16th century that the modern symbolism began to be developed (notably by Francois Viete) in response to the growing complexity of mathematical statements which were impossibly cumbersome when expressed in words. Further research in algebra was aided not only because the symbolism was a convenient 'shorthand' but also because it revealed the similarities between different problems and pointed the way to the discovery of generally applicable methods and principles.

In the mid-19th century, algebra was raised to a completely new level of abstraction. In 1843, Sir William Rowan Hamilton discovered a three-dimensional extension of the number system, which he called 'quaternions', in which the commutative law of multiplication is not generally true; that is, $ab \neq ba$ for most quaternions a and b. In 1854 George Boole applied the symbolism of algebra to logic and found it fitted perfectly except that he had to introduce a 'special law' that a2 = a for all a (called the idempotent law).

Discoveries like this led to the realization that there are many possible 'algebraic structures', which can be described as one or more operations acting on specified objects and satisfying certain laws.

The objective of modern algebra is to study each possible structure in turn, in order to establish general rules for each structure which can be applied in any situation in which the structure occurs. Numerous structures have been studied, and since 1930 a greater level of generality has been achieved by the study of 'universal algebra' which concentrates on properties that are common to all types of algebraic structure.

(adopted from «algebra» The Hutchinson Educational encyclopedia on CD-ROM, 1999)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2 In what context are the proper names and numerals from Exercise 1. mentioned?

Exercise 3. Are the following statements true or false?

1. The word 'algebra' is the Latin origin.
2. The modern symbolism began to be developed from the 16th century
3. Francois Viete introduce the idempotent law.
4. In the early 19th century, algebra was raised to a completely new level of abstraction.
5. The three-dimensional extension of the number system was discovered by Sir William Rowan Hamilton.
6. In 1954 George Boole applied the symbolism of algebra to logic.
7. The 'universal algebra' concentrates on properties that are common to all types of algebraic structure.

Exercise 4. Answer the following questions:

1. Who used the term al-jabr for the process of adding equal quantities to both sides of an equation?
2. When did the modern symbolism begin to be developed?
3. When was algebra raised to a completely new level of abstraction?
4. Who discovered a three-dimensional extension of the number system?
5. What did George Boole do in1854?
6. What is 'algebraic structure'?
7. What is the objective of modern algebra?

Exercise 5. Look through the text above and give the title to it.

Exercise 6. Match the word and its definition.

1.	originally	a.	to accept formally
2.	term	b.	to obtain sight or knowledge of for the first time
3.	adopt	c.	to be found or met with
4.	cumbersome	d.	a word or expression that has an exact meaning in some uses or is limited to a particular field

5.	response	e.	consisting of great numbers
6.	applicable	f.	a mathematical or logical process (as addition or multiplication) for getting one mathematical expression from others according to a rule
7.	discover	g.	hard to handle or manage because of size or weight
8.	operation	h.	in the beginning
9.	occur	i.	capable of being put to use or put into practice
10.	numerous	j.	to fix one's powers, efforts, or attention on one thing
11.	common		
12.	concentrate		

Unit 5. Geometry

Part 1

Exercise 1. Put the words and phrases of the given sentences into the proper order.

1. added original work of his own / into 13 books / Geometry / gathered what was known / in about 300 BC / when the Greek / at the time / was thoroughly organized / collectively called 'Elements' / mathematician Euclid / and arranged 465 propositions /.
2. but also much of / The books / plane and solid geometry / as algebra, trigonometry, and / covered not only / advanced arithmetic / what is now known /.
3. are different / Down through the ages / presented / have been rearranged / many of the proofs / in the 'Elements' / but / the basic idea / and / has not changed / the propositions /.
4. facts / In the work / just / are developed / cataloged / in an orderly way / are not / but /.

Exercise 2. Put the sentences into the proper order and read the whole paragraph.

1. It is true that not everyone must prove things, but everyone is exposed to proof.
2. Even in 300 BC, geometry was recognized to be not just for mathematicians.
3. Geometry provides a simplified universe, where points and lines obey believable rules and where conclusions are easily verified.

4. Politicians, advertisers, and many other people try to offer convincing arguments.
5. Anyone can benefit from the basic teachings of geometry, which are how to follow lines of reasoning, how to say precisely what is intended, and especially how to prove basic concepts by following these lines of reasoning.
6. By first studying how to reason in this simplified universe, people can eventually, through practice and experience, learn how to reason in a complicated world.
7. Anyone who cannot tell a good proof from a bad one may easily be persuaded in the wrong direction.
8. Taking a course in geometry is beneficial for all students, who will find that learning to reason and prove convincingly is necessary for every profession.

Exercise 3. Fill in the gaps with the words from the box.

ancient easier learn resisted tell told was were which who

Geometry in (1)…times (2)…recognized as part of everyone's education. Early Greek philosophers asked that no one come to their schools (3)… had not learned the 'Elements' of Euclid. There(4)…, and still are, many who (5)… this kind of education. It is said that Ptolemy I asked Euclid for an (6)…way to (7)…the material. Euclid (8)…him there was no «royal road» to geometry.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word and its definition.

1.	gather	a.	a geometric element that has position but no dimensions and is pictured as a small dot
2.	proof	b.	to be willing to admit
3.	recognize	c.	to fight against
4.	complicated	d.	a reason for or against something
5.	argument	e.	a final decision reached by reasoning
6.	point	f.	to bring together; collect
7.	benefit	g.	an act or process of showing or finding out that something is true especially by reasoning or by experiment
8.	line	h.	to follow the commands or guidance
9.	obey	i.	consisting of many combined parts; difficult to analyze, understand, or explain

10.	provide	j.	a geometric element that is formed by a moving point and that has length but no width or thickness
11.	conclusion		
12.	resist		

(adopted from «geometry.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Analytic Geometry and Trigonometry

The word geometry is derived from the Greek meaning «earth measurement.» Although geometry originated for practical purposes in ancient Egypt and Babylonia, the Greeks investigated it in a more systematic and general way.

In the 19th century, Euclidean geometry's status as the primary geometry was challenged by the discovery of non-Euclidean geometries. These inspired a new approach to the subject by presenting theorems in terms of axioms applied to properties assigned to undefined elements called points and lines. This led to many new geometries, including elliptical, hyperbolic, and parabolic geometries. Modern abstract geometry deals with very general questions of space, shape, size, and other properties of figures. Projective geometry, for example, is an abstract geometry concerned with the geometric properties that remain invariant under the projection of figures onto other figures, as in the case of mathematical perspective.

Analytic geometry combines the generality of algebra with the precision of geometry. It is sometimes called Cartesian geometry, after Descartes, who was the first to exploit the methods of algebra in geometry. Analytic geometry addresses geometric problems from an algebraic point of view by associating any curve with variables by means of a coordinate system. For example, in a two-dimensional coordinate system, any point on a curve can be associated with a pair of points (a,b). General properties of such curves can then be studied in terms of their algebraic properties.

Trigonometry is the study of triangles, angles, and their relations. It also involves the study of trigonometric functions. There are six trigonometric ratios associated with an angle: sine, cosine, tangent, cotangent, secant, and cosecant. These are especially useful in determining unknown angles or the sides of triangles based upon known trigonometric ratios. In antiquity, trigonometry was used with considerable success by surveyors and astronomers.

(adopted from «mathematics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

spherical triangle algebraic properties trigonometric functions two-dimensional geometry new geometries

Exercise 2. Are the following statements true or false?

1. Geometry was investigated in ancient Egypt and Babylonia in a more systematic and general way than in Greece.
2. Euclidean geometry's had a status of the primary geometry till the 19th century.
3. Projective geometry is an abstract geometry.
4. Analytic geometry combines the generality of algebra with the precision of geometry.
5. Analytic geometry is sometimes called Descartes geometry.
6. Sine, cosine, tangent, cotangent, secant, and cosecant are trigonometric ratios associated with an angle.
7. Trigonometry studies only trigonometric functions.

Exercise 3. Answer the following questions:

1. What does the word geometry mean?
2. When were non-Euclidean geometries discovered?
3. What does modern abstract geometry deal with?
4. How does analytic geometry address geometric problems?
5. Who was the first to exploit the methods of algebra in geometry?
6. What is trigonometry?
7. Who were the first users of trigonometry?

Exercise 4. Match the word and its definition.

1.	purpose	a.	a line connecting points on a graph or in a coordinate system
2.	investigate	b.	to stimulate to greater or higher activity
3.	primaty	c.	being worried and disturbed
4.	inspire	d.	something set up as an end to be attained
5.	approach	e.	way of dealing with something
6.	theorem	f.	to get value or use from
7.	axiom	g.	to study by close examination and systematic inquiry
8.	invariant	h.	a formula, proposition, or statement in mathematics or logic that has been or is to be proved from other formulas or propositions
9.	challenge	i.	not changing or altering
10.	exploit	j.	a rule or principle widely accepted as obviously true and not needing to be proved
11.	curve		
12.	concerned		

Part 3

Non-Euclidean Geometry

In the 19th century, many mathematicians began questioning one of Euclid's main premises: that, simply stated, two lines are parallel if, no matter how far they are extended in either direction, they never intersect, but always remain the same distance apart from each other. The German mathematician Bernhard Riemann, by extending Euclid's basically two-dimensional geometry into three or more dimensions, showed among other things that there are no lines parallel to the given line. This idea eventually became essential to Einstein's development of the theory of relativity.

Spherical geometry, another field developed in the 19th century, is concerned with circles, globes, and spheres and their properties. Spheres have no corners of any kind but only one smooth surface. No straight lines can be drawn on a sphere, but any two points on it can be connected by an arc which, if extended, would go all the way around the sphere, dividing it into hemispheres. This is the largest kind of circle that can be drawn on a sphere, and it is called a great circle. Great circles can form angles and triangles and other polygons. They can, in fact, do anything that lines do on a plane except be parallel. Any two great circles meet each other at two diametrically opposite points. Small circles (for example, the lines of latitude on Earth above and below the equator) can be parallel, but they do not have the other properties of straight lines.

One of the better-known facts of plane geometry, another 19th-century development, is that the angles of a triangle add up to one straight angle, or 180°. This may appear to have nothing to do with parallel lines, but the relationship cannot be proved without using parallel lines. It should therefore be expected that the sum of the angles in a spherical triangle would not be the same as that in a plane triangle. The angles of a spherical triangle always add up to more than 180°. The larger the triangle, the greater the amount by which the sum exceeds 180°.

(adopted from «geometry.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

main premises sphere trigonometry angle parabolic geometry

Exercise 2. Are the following statements true or false?

1. One of Euclid's main premises says that two lines are parallel if, no matter how far they are extended in either direction, they never intersect, but always remain the same distance apart from each other.
2. Bernhard Riemann was the German mathematician.
3. Spherical geometry developed in the 18th century.
4. Straight lines can not be drawn on a sphere.

5. Small circles can not be parallel.
6. Any two great circles meet each other at one point.
7. The sum of the angles in a spherical triangle can be more than 180°.

Exercise 3. Answer the following questions:

1. What did Bernhard Riemann prove?
2. Who developed the theory of relativity?
3. What science is concerned with circles, globes, and spheres and their properties?
4. When did spherical geometry develop?
5. What is a great circle?
6. What kind of figures can the great circles form?
7. When was it proved that the angles of a triangle add up to one straight angle, or 180°?

Exercise 4. Match the word and its definition.

1. premise	a. to meet and cross at one or more points
2. no matter	b. a statement taken to be true and used as a basis for argument or reasoning
3. intersect	c. a solid geometric shape whose surface is made up of all the points that are an equal distance from the point that is the shape's center
4. globe	d. a continuous portion of a curved line (as part of the circumference of a circle)
5. essential	e. fwithout regard to
6. circle	f. something basic, necessary, or indispensable
7. sphere	g. to come to a total and especially the expected total
8. corner	h. one of two halves of a sphere
9. arc	i. a line segment that is curved so that its ends meet and every point on the line is equally far away from a single point inside
10. hemisphere	j. a geometric figure that is closed, that lies in a plane, and whose edges are all straight lines
11. polygon	
12. add up	

Unit 6. Subdivisions of Mathematics

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

1. An infinite set has an endless number of members.
2. Set theory deals with the properties of well-defined collections of objects.
3. For example, all of the positive integers compose an infinite set.
4. Sets may be finite or infinite.
5. A finite set has a definite number of members; such a set might consist of all the integers from 1 to 1,000.
6. Created in the 19th century by the German mathematician Georg Cantor, set theory was originally meant to provide techniques for the mathematical analysis of the infinite.

Exercise 2. Put the words and phrases of the given sentences into the proper order.

1. Cantor developed to go along with them / numbers and transfinite arithmetic / a theory of infinite /.
2. the set of all real numbers / conjectures that / His 'Continuum Hypothesis' / is the second smallest / infinite set /.
3. the integers or any / The smallest infinite set / set equivalent to it / is composed of /.
4. and purely logical paradoxes / Early in the 20th century / concerning infinite sets / to axiomatize set theory / transfinite numbers / brought about attempts / in hopes of eliminating / such difficulties / certain contradictions of set theory /.
5. it seemed that the traditional / When Kurt Gödel showed / had been suddenly lost / that, for any axiomatic system / devised that were neither true nor false / certainty of mathematics / propositions could be /.

Exercise 3. Fill in the gaps with the words from the box.

meant at proved in succeeded theory postulate possible prove

(1)… the 1960s Paul Cohen (2)… in showing the independence of the 'Continuum Hypothesis', namely that it could be neither (3)… nor disproved within a given axiomatization of set (4)…. This (5)… that it was (6)… to contemplate non-Cantorian set theories in which the 'Continuum Hypothesis' might be negated, much as non-Euclidean geometries treat geometry without assuming the necessary validity of Euclid's parallel (7)….

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word and its definition.

1. postulate	a. to deny the existence or truth of
2. property	b. a statement that seems to go against common sense but may still be true
3. finite	c. to view or consider with careful and thoughtful attention
4. negate	d. a special quality of something
5. contradiction	e. to get rid of
6. technique	f. having certain limits
7. paradox	g. to form in the mind by new combinations or applications of ideas or principles : invent
8. infinite	h. a statement or claim assumed to be true especially as the basis of a process of reasoning
9. eliminate	i. to reach a desired end or object
10. devise	j. a condition in which things oppose each other
11. succeed	
12. contemplate	

(adopted from «mathematics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Probability Theory

The branch of mathematics concerned with the analysis of random phenomena is called probability theory. The entire set of possible outcomes of a random event is called the sample space. Each outcome in this space is assigned a probability, a number indicating the likelihood that the particular event will arise in a single instance.

Hundreds of years ago mathematicians devised a way of measuring the uncertainties found in things such as games of chance and created a new branch of mathematics—probability. The principles of probability are widely used. In genetics, for example, probability is used to estimate the likelihood for brown-eyed parents to produce a blue-eyed child. In business, insurance companies use the principles of probability to determine risk groups.

Probability is closely related to statistics since uncertainty always exists when statistical predictions are being made. There is, however, a fundamental difference between the two fields. In statistics, a sample drawn from an unknown population is used to determine what the population is like. In probability, the population is completely known; the unknown element is the likelihood of obtaining a particular sample from the population.

If a coin is flipped once, there are two possible outcomes—heads and tails. Since one side of the coin is as likely to turn up as the other, these outcomes are called equally likely outcomes. Probability is expressed as the ratio of favorable outcomes to the total number of equally likely outcomes. So the probability of obtaining heads is 1:2—that is, one to two, or 1 / 2. This probability does not mean that heads will always occur once in every two flips; it means that heads is likely to occur once in every two flips.

(adopted from «probability.» ,»mathematics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

theories of measure   favorable outcomes   probability theory   calculus statistical predictions

Exercise 2. Are the following statements true or false?

1. Probability theory is the branch of mathematics concerned with the analysis of random phenomena.
2. The sample space is the entire set of possible outcomes of a random event.
3. The principles of probability can be used in genetics.
4. The principles of probability are not used in business.
5. Probability is closely related to statistics.
6. Probability is expressed as the ratio of the total number of equally likely outcomes to favorable outcomes.
7. When a coin is flipped, heads will always occur once in every two flips.

Exercise 3. Answer the following questions:

1. What is probability theory?
2. What is a sample space?
3. When was probability created?
4. Where are the principles of probability used?
5. What is the difference between probability and statistics?
6. What are equally likely outcomes?
7. What is probability of obtaining heads when a coin is flipped?

Exercise 4. Match the word and its definition.

1. branch	a. a part used for investigating the whole
2. principle	b. a general or basic truth on which other truths or theories can be based
3. devise	c. probability
4. estimate	d. to find out or come to a decision
5. likelihood	e. of central importance
6. relate	f. making up the whole
7. fundamental	g. a separate or subordinate division or part of a central system
8. sample	h. determine
9. ratio	i. result
10. determine	j. to have relationship or connection
11. total	
12. outcome	

Part 3
Calculus

The field of mathematics called calculus deals with change in processes or systems. In science many quantities change as we deal with them. The heat in a billet of steel begins to lessen the instant the billet is poured from molten metal. The number of bacteria in a culture changes measurably every fraction of a second. So, likewise, does the direction of a planet's motion in space as it speeds along its orbit around the sun.

In such instances we may want to know the rate of change. We may also want to know the rate as a basis for figuring the amount of change over a certain interval of space or time. The methods that solve these problems determine areas or volumes embraced within curved lines or surfaces—a calculation that often cannot be made with arithmetic or algebra.

The mathematical methods that have been devised for dealing with such problems make up calculus. Two mathematicians, Sir Isaac Newton of England and Gottfried Wilhelm Leibniz of Germany, share credit for independently developing calculus in the 17th century. The name, like the word calculate, is from the Latin term meaning «pebble,» from the ancient custom of using pebbles as counters in solving arithmetic problems.

In the 19th century, in response to questions about its rigorous foundations, the calculus was developed in terms of a theory of limits. Analysis—differential and integral calculus—was subsequently approached even more rigorously by those who sought to establish its results by strictly arithmetic means. This required an exact definition of the continuity of the real numbers. Others extended the power of analysis with very general theories of measure.

Analysis gives primary emphasis to functions, convergence of sequences, series, continuity, differentiability, and questions about the completeness of the real numbers. Introductory courses in calculus generally include study of logarithms, exponential functions, trigonometric functions, and transcendental functions.

(adopted from «mathematics.», «calculus.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

a theory of limits sample space rate of change analysis likelihood

Exercise 2. Are the following statements true or false?

1. Calculus deals with change in processes or systems.
2. The direction of a planet's motion in space as it speeds along its orbit around the sun can not change.
3. Calculus was developed in the 19th century.
4. Newton and Leibniz discovered calculus independently.
5. Pebbles were used as counters in solving arithmetic problems.
6. In the 17th century the calculus was developed in terms of a theory of limits.
7. Analysis gives primary emphasis to functions, convergence of sequences, series, continuity, differentiability, and questions about the completeness of the real numbers.

Exercise 3. Answer the following questions:

1. What is calculus?
2. Who discovered calculus?
3. What is the origin of the word calculus?
4. When was the calculus developed in terms of a theory of limits?
5. What do introductory courses in calculus generally include?
6. What for is calculus used?
7. Who approached analysis?

Exercise 4. Match the word and its definition.

1. instance	a. with respect to or in relation to
2. credit	b. to gain full recognition or acceptance of
3. emphasis	c. very accurate
4. embrace	d. to begin to deal with
5. rigorous	e. special attention or importance given to something
6. in terms of	f. a statement of the meaning of a word or word group or a sign or symbol
7. approach	g. example
8. seek	h. to make larger
9. primary	i. to try to discover
10. establish	j. something that adds to a person's reputation or honor
11. definition	
12. extend	

Unit 7. Mathematics and Computing

Part 1

Exercise 1. Put the words and phrases of the given sentences into the proper order.

1. the decimal numbering system / we use / In most of our / everyday lives /.
2. that can be combined / The system / to form / uses 10 digits / larger numbers /.
3. computers use / Because a computer's / the binary number system / has only two states / electronic switch /.
4. has only two / 0 and 1 / This system / digits, or bits /.

Exercise 2. Fill in the gaps with the words from the box.

enough works equal represent letter data value work digits

A computer generally (1)… with groups of bits at a time. A group of eight bits is called a byte. A byte can (2)… the 256 different binary values 00000000 through 11111111, which are (3)… to the decimal values 0 through 255. That is (4)… values to assign a numeric code to each (5)… of the Latin alphabet (both upper and lower case, plus some accented letters), the 10 decimal (6)…, punctuation marks, and common mathematical and other special symbols. Therefore, depending on a program's context, the binary value 01000001 can represent the decimal value 65, the capital letter A, or an instruction to the computer to move (7)… from one place to another.

Exercise 3. Put the sentences into the proper order and read the whole paragraph.

1. The amount of data that can be stored in a computer's memory or on a disk is referred to in terms of numbers of bytes.
2. To deal with such large numbers, the abbreviations K, M, and G (for «kilo,» «mega,» and «giga,» respectively) are often used.
3. Computers can store billions of bytes in their memory, and a modern disk can hold tens, or even hundreds, of billions of bytes of data.
4. An 80 GB (gigabyte) disk stores about 80 billion characters.
5. The abbreviation B stands for byte, and b for bit.
6. K stands for 210 (1,024, or about a thousand), M stands for 220 (1,048,576, or about a million), and G stands for 230 (1,073,741,824, or about a billion).
7. So a computer that has a 256 MB (megabyte) memory can hold about 256 million characters.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word and its definition.

1. state	a.	a numerical quantity that is assigned or is found by calculation or measurement
2. generally	b.	to change the place or position of
3. byte	c.	the parts of something written or spoken that are near a certain word or group of words and that help to explain its meaning
4. value	d.	as a rule
5. digit	e.	the total number or quantity
6. context	f.	a round flat plate coated with a magnetic substance on which data for a computer is stored
7. data	g.	information in numerical form for use especially in a computer
8. move	h.	manner or condition of being
9. amount	i.	a shortened form of a written word or phrase used in place of the whole
10. disk	j.	a group of eight bits that a computer handles as a Unit
11. memory		
12. abbreviation		

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

There are two fundamentally different types of computers—analog and digital. (Hybrid computers combine elements of both types.) Analog computers solve problems by using continuously changing data (such as temperature, pressure, or voltage) rather than by manipulating discrete binary digits (1s and 0s) as a digital computer does. In current usage, the term computer usually refers to digital computers. Digital computers are generally more effective than analog computers for three principal reasons: they are not as susceptible to signal interference; they can convey data with more precision; and their coded binary data are easier to store and transfer than are analog signals.

Analog computers work by translating data from constantly changing physical conditions into corresponding mechanical or electrical quantities. They offer continuous solutions to the problems on which they are operating. For example, an automobile speedometer is a mechanical analog computer that measures the rotations per minute of the drive shaft and translates that measurement into a display of miles or kilometers per hour. Electronic analog computers in chemical plants monitor temperatures, pressures, and flow rates.

They send corresponding voltages to various control devices, which, in turn, adjust the chemical processing conditions to their proper levels. Although digital computers have become fast enough to replace most analog computers, analog computers are still common for flight control systems in aviation and space vehicles.

For all their apparent complexity, digital computers are basically simple machines. Every operation they perform, from navigating a spacecraft to playing a game of chess, is based on one key operation: determining whether certain electronic switches, called gates, are open or closed. The real power of a computer lies in the speed with which it checks these switches.

A computer can recognize only two states in each of its millions of circuit switches—on or off, or high voltage or low voltage. By assigning binary numbers to these states—1 for on and 0 for off, for example—and linking many switches together, a computer can represent any type of data, from numbers to letters to musical notes. This process is called digitization.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it and put them in the order they appear.

binary numbers computer-assisted mathematics electronic analog computers calculations complicated simple machines

Exercise 2. Are the following statements true or false?

1. There are three fundamentally different types of computers.
2. In current usage, the term computer usually refers to digital computers.
3. Digital computers can convey data with more precision than analog ones.
4. An automobile speedometer is a mechanical analog computer.
5. Analog computers are not used for flight control systems in aviation and space vehicles.
6. The real advantage of a computer lies in its speed.
7. Computers use the binary number system.

Exercise 3. Answer the following questions:

1. What are fundamentally different types of computers?
2. What is the difference between analog and digital computers?
3. Why are digital computers more effective?
4. Where are analog computers used?
5. What is every operation of digital computers based on?
6. How many states can a computer recognize?
7. What is digitization?

Exercise 4. Look through the text and give the title to it.

Exercise 5. Match the word and its definition.

1. solve	a. a good basis
2. discrete	b. easily affected or impressed
3. current	c. an electronic device that gives information in visual form
4. reason	d. separate
5. susceptible	e. to watch, observe, or check for a special purpose
6. convey	f. to serve as a way of carrying
7. combine	g. to find a solution for
8. display	h. a device for making, breaking, or changing the connections in an electrical circuit
9. monitor	i. occurring in or belonging to the present time
10. precision	j. quickness in movement or action
11. switch	
12. speed	

Part 3

Mathematicians have always dreamed of possessing machines that would remove the drudgery from their work. The inventor of logarithms, John Napier, also invented a system of carved ivory rods for doing multiplication, known as Napier's bones. Blaise Pascal built the first mechanical calculator in 1642. In 1835 Charles Babbage designed a calculating machine that could modify its own instructions, a forerunner of today's computers. Two of the true parents of the computer, John Von Neumann and Alan Turing, were mathematicians.

Until the 1970s, computers were used as glorified calculators, for ` number crunching´ - performing what were essentially just long and complicated calculations in arithmetic. Many mathematical problems, however, require understanding, not just a numerical answer. More and more, computers are being used by mathematicians as `experimental´ tools: to investigate aspects of mathematical problems, test predictions, and prove the correctness of theories. Computer scientists have also responded to mathematicians' needs by devising symbolic computation systems. These manipulate algebraic expressions in the same way that a human mathematician would - only faster and more accurately. The result might be called `computer-assisted mathematics´: the computer does not make mathematicians obsolete, but it adds enormously to their power, bringing within their range problems that had hitherto seemed impossible.

Computation and mathematics have always been closely related. This strong interaction between computing and mathematics will let the mathematician of the future spend more time thinking about concepts, and less time performing routine calculations. Computers, moreover, open up a whole new range of problems that mathematicians would not otherwise have thought of, and offer new perspectives from which to find answers.

(adopted from «Mathematics and Computing » The Hutchinson Educational encyclopedia on CD-ROM, 1999)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

digitization calculating machine hybrid computers symbolic computation systems routine calculations

Exercise 2. Are the following statements true or false?

1. John Napier invented logarithms.
2. Blaise Pascal built the first mechanical calculator in 1835.
3. Blaise Pascal designed a calculating machine that could modify its own instructions.
4. Computers are being used by mathematicians as `experimental´ tools.
5. The computer makes mathematicians obsolete.
6. Computation and mathematics are closely related.
7. Computers open up a new range of problems that mathematicians would not otherwise have thought of.

Exercise 3. Answer the following questions:

1. What did John Napier invent?
2. What is known as Napier's bones?
3. When was the first mechanical calculator built?
4. Who designed a calculating machine that could modify its own instructions?
5. How were computers used until the 1970s?
6. What for do mathematicians use computers now?
7. How will strong interaction between computing and mathematics help the mathematician of the future?

Exercise 4. Look through the text and give the title to it.

Exercise 5. Match the word and its definition.

1. remove	a. to alter, to make different
2. drudgery	b. to invent, to contrive
3. calculator	c. a predecessor, an ancestor
4. glorified	d. hard menial or tedious work

5. modify	e. up to this place, limit or time
6. forerunner	f. any regular or mechanical habit or practice
7. respond	g. connected
8. obsolete	h. an electronic device, usu. Small and portable, which can carry out mathematical calculations
9. devise	i. to take away, to get rid of
10. hitherto	j. to answer, to make reply
11. related	
12. routine	

5. READING ROOM FOR STUDENTS OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

Unit 1. History of the Computer

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. They added a keyboard and monitor to their computer and offered a means of storing programs on a cassette recorder.
b. The first affordable desktop computer designed specifically for personal use was called the Altair 8800 and was sold by Micro Instrumentation Telemetry Systems in 1974.
c. By the mid-1970s microchips and microprocessors had drastically reduced the cost of the thousands of electronic components required in a computer.
d. In 1977 Tandy Corporation became the first major electronics firm to produce a personal computer.

Exercise 2. Fill in the gaps with the words from the box and read the whole paragraph.

company computers computing drives games graphics legitimate monitor popular spreadsheet

Soon afterward, entrepreneur Steven Jobs and Stephen Wozniak, his engineer partner, founded a small (1) … named Apple Computer, Inc. They introduced the Apple II computer in 1977. Its (2) … supported relatively high-quality color (3) … , and it had a floppy-disk drive. The machine initially was (4) … for running video (5) …. In 1979 Daniel Bricklin wrote an electronic (6) … program called VisiCalc that ran on the Apple II. Suddenly businesses had a (7) … reason to buy personal computers, and the era of personal (8) … began in earnest.

Exercise 3. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

a. 1981/introduced/Personal Computer (PC)/IBM/its/in.

b. of clones (computers that worked exactly like an IBM PC)/drastically/the makers/the price/As a result of/of personal computers/competition/from/fell.
c. than/By the 1990s/from the 1950s/far more powerful/personal computers/the multimillion-dollar machines/were.
d. In rapid succession/and/shrank/computers/to laptop/to palm-size/tabletop/finally/from.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word or phrase with its definition.

1. desktop	a. a portable computer that is small enough to use on one's lap, has its main components (as keyboard and display screen) combined in one unit, and can run on battery power
2. means	b. a game played with images on a video screen
3. entrepreneur	c. an accounting program for a computer
4. engineer	d. a personal computer that is designed to be used on an office desk
5. floppy-disk drive	e. rapidly or violently
6. video game	f. one who organizes, manages, and takes on the risks of a business or enterprise
7. spreadsheet	g. a handheld IBM compatible computer
8. era	h. a period of time beginning with some special date or event
9. clone	i. something by which a desired result is achieved or furthered
10. drastically	j. a common magnetic storage device that reads and writes data on a floppy disk
11. laptop	
12. palm-size	

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2
ENIAC

The modern computer grew out of intense research efforts mounted during World War II. The military needed faster ballistics calculators, and British cryptographers needed machines to help break the German secret codes.

The distinction as the first general-purpose electronic computer properly belongs to ENIAC (Electronic Numerical Integrator and Computer). Designed by two American engineers, John W. Mauchly and J. Presper Eckert, Jr., ENIAC went into service at the University of Pennsylvania in 1946. Its construction was an enormous feat of engineering—the 30-ton machine was 18 feet (5.5 meters) high and 80 feet (24 meters) long, and contained 17,468 vacuum tubes linked by 500 miles (800 kilometers) of wiring. ENIAC performed about 5,000 additions per second. Its first operational test included calculations that helped determine the feasibility of the hydrogen bomb.

To change ENIAC's instructions, or program, engineers had to rewire the machine, a process that could take several days. The next computers were built so that programs could be stored in internal memory and could be easily changed to adapt the computer to different tasks. These computers followed the theoretical descriptions of the ideal «universal» (general-purpose) computer first outlined by English mathematician Alan Turing and later John von Neumann a Hungarian-born mathematician.

The invention of the transistor in 1947 brought about a revolution in computer development. Hot, unreliable vacuum tubes were replaced by small germanium (later silicon) transistors that generated little heat yet functioned perfectly as switches or amplifiers.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numbers.

Exercise 2. Look through the text and define which of the following keywords are mentioned in it.

hydrogen bomb	mainframe computers	minicomputers	transistor
World War II			

Exercise 3. In what context are the proper names and numbers from Exercise 1 mentioned?

Exercise 4. Are the following statements true or false?
1. The modern computer is a result of hard research work during World War II.
2. The German cryptographers needed machines to help break the British secret codes.
3. ENIAC was the second successful attempt to create general-purpose electronic computer properly.
4. ENIAC was designed by British engineers.
5. ENIAC was very big: 18 feet (5.5 meters) high and 80 feet (24 meters) long.
6. To change ENIAC's program engineers had to switch the machine off and to switch it on in several days.

7. ENIAC did not follow the theoretical descriptions of the ideal «universal» (general-purpose) computer first outlined by English mathematician Alan Turing and later John von Neumann a Hungarian-born mathematician

Exercise 5. Answer the following questions:

1. Who designed ENIAC?
2. What does the abbreviation ENIAC stand for?
3. What were the physical characteristics of ENIAC?
4. In what way did ENIAC differ from next computers?
5. What did Alan Turing first outline?
6. When the next revolution in computer development took place and what was it caused by?
7. How did transistors come over switches and amplifiers?

Exercise 6. Match the word or phrase with its definition.

1. ballistics	a. a system of wires
2. cryptographer	b. extraordinarily great in size, number, or degree
3. general-purpose	c. existing only in theory
4. enormous	d. having a wide range of different uses
5. vacuum tube	e. an electronic device that consists of a small block of a semiconductor with at least three electrodes and is used to control the flow of electricity in electronic equipment
6. wiring	f. a code that tells a computer to perform a particular operation
7. instruction	g. the science that deals with the motion of objects (as bullets or rockets) that are thrown or driven forward
8. store	h. to change so as to fit a new or specific use or situation
9. adapt	i. to record information in a computer)
10. task	j. an electron tube from which most of the air has been removed
11. theoretical	
12. transistor	

Part 3

Mainframes, Supercomputers, and Minicomputers

IBM introduced the System/360 family of computers in 1964 and then dominated mainframe computing during the next decade for large-scale commercial, scientific, and military applications. The System/360 and its successor,

the System/370, was a series of computer models of increasing power that shared a common architecture so that programs written for one model could run on another.

Also in 1964, Control Data Corporation introduced the CDC 6600 computer, which was the first supercomputer. It was popular with weapons laboratories, research organizations, and government agencies that required high performance. Today's supercomputer manufacturers include IBM, Hewlett-Packard, NEC, Hitachi, and Fujitsu.

Beginning in the late 1950s, Digital Equipment Corporation (DEC) built a series of smaller computers that it called minicomputers. These were less powerful than the mainframes, but they were inexpensive enough that companies could buy them instead of leasing them. The first successful model was the PDP-8 shipped in 1965. It used a typewriter-like device called a Teletype to input and edit programs and data. In 1970 DEC delivered its PDP-11 minicomputer, and in the late 1970s it introduced its VAX line of computers. For the next decade, VAX computers were popular as departmental computers within many companies, organizations, and universities. By the close of the 20th century, however, the role of minicomputers had been mostly taken over by PCs and workstations.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numbers.

Exercise 2. Look through the text and define which of the following keywords are mentioned in it.

general-purpose	mainframe	manufacturer	supercomputer	transistor

Exercise 3. In what context are the proper names and numbers from Exercise 1 mentioned?

Exercise 4. Are the following statements true or false?

1. IBM dominated mainframe computing during the late 1960s-1970s.
2. The System/360 was more powerful than its successor, the System/370.
3. The first supercomputer was introduced in 1964.
4. The performance of the first supercomputer was not enough for weapons laboratories, research organizations, and government agencies.
5. Minicomputers started to appear in the late 1950s.
6. I was less costly for companies to lease the first minicomputers than buy them.
7. VAX computers were popular in the early 1970s.

Exercise 5. Answer the following questions.

1. What company dominated mainframe computing for the whole decade after 1964?
2. What was common in the System/360 and its successor, the System/370?
3. Why was CDC 6600 popular?
4. Who created first smaller computers and how did this company call them?
5. What was the main advantage of smaller computers compared with the mainframes?
6. What did it use to input and edit data?
7. What had taken the role of VAX computers by the end of the 20th century?

Exercise 6. Match the word with its definition.

1. mainframe	a. a powerful desktop computer used by users for work that requires a lot of processing
2. military	b. used by the most of the departments of a company or business
3. successor	c. to correct and revise
4. supercomputer	d. a small computer that is between a mainframe and a personal computer in size and speed
5. weapon	e. a large fast computer that can do many jobs at once
6. minicomputers	f. a small general-purpose computer with a microprocessor
7. lease	g. one that follows
8. typewriter	h. something with which one fights or struggles against another
9. edit	i. a large very fast computer used especially for scientific computations
10. departmental	j. an agreement to hand over real estate for a period of time usually for a specified rent
11. PC	
12. workstation	

Unit 2. Hardware

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. The user selects operations, activates commands, or creates or changes images on the screen by pressing buttons on the mouse.

b. Computer keyboards, which are much like typewriter keyboards, are the most common input devices.

c. Components known as input devices let users enter commands, data, or programs for processing by the CPU.

d. Information typed at the keyboard is translated into a series of binary numbers that the CPU can manipulate.

e. To move the cursor on the display screen, the user moves the mouse around on a flat surface.

f. Another common input device, the mouse, is a mechanical or optical device with buttons on the top and either a rolling ball or an optical sensor in its base.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1. output devices/that/are known/let/Components/of the computer's/the results/the user/data processing/as/see or hear.
2. and/a cathode-ray tube (CRT)/to show/graphics/is/the video display terminal (VDT)/characters/or liquid-crystal display (LCD)/on a television-like screen/or monitor/which uses/The most common one.

Exercise 3. Fill in the gaps with the words from the box and read the whole paragraph.

computer	computers	cost	devices	memory	modem	modems
network	printer	printers	telephone			

(1) … (modulator-demodulators) are input/output (I/O) (2) … that allow (3) … to transfer data between each other. A basic (4) … on one computer translates digital pulses into analog signals (sound) and then transmits the signals through a (5) … line or a communication (6) … to another computer. A modem on the computer at the other end of the line reverses the process.

(7) … generate hard copy—a printed version of information stored in one of the computer's (8) … systems. Color ink-jet and black-and-white laser printers are most common, though the declining (9) … of color laser printers has increased their presence outside of the publishing industry. Most PCs also have audio speakers. These allow the user to hear sounds, such as music or spoken words, that the computer generates.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word or phrase with its definition.

1. input devices	a. a piece of equipment used for putting data into computer
2. keyboard	b. an output device for providing sound output
3. sensor	c. information in numerical form for use especially in a computer
4. cursor	d. a device that detects a physical quantity (as a movement or a beam of light) and responds by transmitting a signal
5. data	e. the surface on which the image appears in an electronic display
6. output device	f. a mark (as a bright blinking spot) on a computer display screen that shows the place where the user is working
7. monitor	g. the main electronic input device that has keys arranged in a similar layout to a typewriter
8. screen	h. an electronic display device that uses liquid crystal cells to control the reflection of light
9. liquid-crystal display	i. an electronic device that converts signals to enable a computer to be connected to an ordinary telephone line
10. modem	j. a piece of equipment that processes data or signals that come out of a computer system
11. printer	
12. audio speakers	

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2
The central processing unit

The heart of a computer is the central processing unit (CPU). In addition to performing arithmetic and logic operations on data, it times and controls the rest of the system. Mainframe and supercomputer CPUs sometimes consist of several linked microchips, called microprocessor, each of which performs a separate task, but most other computers require only a single microprocessor as a CPU.

Most CPUs have three functional sections:

the arithmetic/logic unit (ALU), which performs arithmetic operations (such as addition and subtraction) and logic operations (such as testing a value to see if it is true or false);

temporary storage locations, called registers, which hold data, instructions, or the intermediate results of calculations; and

the control section, which times and regulates all elements of the computer system and also translates patterns in the registers into computer activities (such as instructions to add, move, or compare data).

A very fast clock times and regulates a CPU. Every tick, or cycle, of the clock causes each part of the CPU to begin its next operation and to stay synchronized with the other parts. The faster the CPU's clock, the faster the computer can perform its tasks. The clock speed is measured in cycles per second, or hertz (Hz). Today's desktop computers have CPUs with 1 to 4 GHz (gigahertz) clocks. The fastest desktop computers therefore have CPU clocks that tick 4 billion times per second. The early PCs had CPU clocks that operated at less than 5 MHz. A CPU can perform a very simple operation, such as copying a value from one register to another, in only one or two clock cycles. The most complicated operations, such as dividing one value by another, can require dozens of clock cycles.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numbers.

Exercise 2. Look through the text and define which of the following keywords are mentioned in it.

arithmetic operations	circuit boards	computer system
logic operations	memory chips	

Exercise 3. In what context are the proper names and numbers from Exercise 1 mentioned?

Exercise 4. Are the following statements true or false?

1. The central processing unit times and controls the rest of the system.
2. Mainframe CPUs consist of several linked microchips, which perform the same task.
3. ALU only performs arithmetic operations.
4. Temporary storage locations hold data, instructions, or the intermediate results of calculations.
5. The CPU's clock speed is measured in cycles per minute, or hertz.
6. A CPU can perform copying a value from one register to another in one or two clock cycles.
7. A CPU needs dozens of clock cycles dividing one value by another.

Exercise 5. Answer the following questions.

1. What are the functions of the CPU?
2. How many CPUs does the usual computer have?
3. Which functional sections does the CPU have?
4. What is the function of the control section?
5. How does the computer performance depend on the CPU's clock?
6. What does hertz mean?
7. What time can a CPU need for simple and complicated operations?

Exercise 6. Match the word with its definition.

1. arithmetic	a. a tiny group of electronic devices and their connections that is produced in or on a small slice of material
2. mainframe	b. to have a need for
3. supercomputer	c. complex or difficult
4. microchip	d. a period of time taken up by a series of events or actions that repeat themselves regularly and in the same order
5. temporary	e. a set of characteristics that are displayed repeatedly
6. intermediate	f. a large fast computer that can do many jobs at once
7. calculation	g. to work in a proper way
8. pattern	h. dealing with real numbers and their addition, subtraction, multiplication, and division
9. cycle	i. not permanent
10. operate	j. being or occurring in the middle or between extremes
11. complicated	
12. require	

Part 3

Internal memory

Most digital computers store data both internally, in what is called main memory, and externally, on auxiliary storage units. As a computer processes data and instructions, it temporarily stores information in main memory, which consists of random-access memory (RAM). Random access means that each byte can be stored and retrieved directly, as opposed to sequentially as on magnetic tape.

Memory chips are soldered onto the printed circuit boards, or RAM modules, that plug into special sockets on a computer's motherboard. With memory requirements for personal computers having increased, typically from four to 16 memory chips are soldered onto a module. In dynamic RAM, the type of RAM commonly used for general system memory, each chip consists of millions of

transistors and capacitors. (Each capacitor holds one bit of data, either a 1 or a 0. Today's memory chips can each store up to 512 Mb (megabits) of data; a set of 16 chips on a RAM module can store up to 1 GB of data. This kind of internal memory is also called read/write memory).

Another type of internal memory consists of a series of read-only memory (ROM) chips. Unlike in RAM, what is stored in ROM persists when power is removed. Thus, ROM chips are stored with special manufacturer instructions that normally cannot be accessed or changed. The programs stored in these chips correspond to commands and programs that the computer needs in order to boot up, or ready itself for operation, and to carry out basic operations. Because ROM is actually a combination of hardware (microchips) and software (programs), it is often referred to as firmware.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numbers.

Exercise 2. Look through the text and define which of the following keywords are mentioned in it.

computer system	external memory	firmware	internal memory
system memory			

Exercise 3. In what context are the proper names and numbers from Exercise 1 mentioned?

Exercise 4. Are the following statements true or false?

1. Most digital computers store data internally and externally.
2. Computer temporarily stores information in main memory, in which each byte can be stored and retrieved sequentially.
3. RAM modules plug into any sockets on a computer's motherboard.
4. Dynamic RAM is commonly used for general system memory.
5. RAM chips are stored with special manufacturer instructions that normally cannot be accessed or changed.
6. ROM stores programs that the computer needs in order to boot up and to carry out basic operation.
7. ROM is a combination of hardware and software.

Exercise 5. Answer the following questions:

1. How are the main types of memory called?
2. How is information stored and retrieved on magnetic tape?
3. How is information stored and retrieved in main memory?
4. What does the memory chip consist of?
5. In which memory type does the information remain when the computer is switched off?

6. What do ROM chips store?
7. What is called firmware and why?

Exercise 6. Match the word or phrase with its definition.

1. digital computer	a. to get and bring back; to recover (as information) from storage
2. main memory	b. to start or make ready for use especially by booting a program
3. random-access memory	c. the programs and related information used by a computer
4. retrieve	d. a computer that operates with numbers expressed as digits (as in the binary system)
5. motherboard	e. a computer memory that acts as the main storage available to the user for programs and data
6. read-only memory	f. the physical component of a computer system
7. analogue computer	g. a usually small computer memory that contains special-purpose information (as a program) which cannot be altered
8. chip	h. a device that is a combination of hardware and software
9. boot up	i. the main circuit board of a personal computer
10. hardware	j. the electronic memory that holds the programs and data being used
11. software	
12. firmware	

Unit 3. Software

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

1. The eight programs that run each craft in the space shuttle program, for example, consist of a total of about half a million separate instructions and were written by hundreds of programmers.
2. Software is written by professionals known as computer programmers.
3. For this reason, scientific and industrial software sometimes costs much more than the computers on which the programs run.

4. Most programmers in large corporations work in teams, with each person focusing on a specific aspect of the total project.
5. Individual programmers can work for profit, as a hobby, or as students, and they are solely responsible for an entire project.

Exercise 2. Fill in the gaps with the words from the box and read the whole paragraph.

algorithms	algorithms	information	pay rate	paychecks
personnel	processing	program	steps	

Computer programs consist of data structures and (1)…. Data structures represent the (2) … that the program processes. Algorithms are the sequences of (3) … that a program follows to process the information. For example, a payroll application program has data structures that represent (4) … information, including each employee's hours worked and (5) …. The program's (6) … include instructions on how to compute each employee's pay and how to print out the (7) ….

Exercise 3. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1. program development/in/is/Often/the most difficult/the debugging stage/step.
2. of/are/Problems/subprograms/dozens of modules/program design and logic/often/which consist/broken up into/called subroutines/difficult to spot/or/in/in large programs/even smaller units.
3. a program/Also/bugs/if /is considered/is slower/it/it/it/less efficient/might/or/should be/than/though/to have/work correctly.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word or phrase with its definition.

1. professional	a. a check in payment of wages or salary
2. programmer	b. a step-by-step method for solving a problem
3. team	c. the region beyond the earth's atmosphere
4. project	d. a person who engages in an activity professionally
5. craft	e. the gain or benefit from something
6. space	f. a person who writes computer programs
7. profit	g. an interest or activity to which a person devotes time for pleasure

8. hobby — h. a machine that can travel through the air and that is supported either by its own buoyancy or by the action of the air against its surfaces

9. algorithm — i. a number of persons associated together in work or activity

10. payroll application program — j. a computer program used for calculating paychecks

11. personnel

12. paycheck

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Programming languages

On the first electronic computers, programmers had to reset switches and rewire computer panels in order to make changes in programs. Although programmers still must «set» (to 1) or «clear» (to 0) millions of switches in the microchips, they now use programming languages to tell the computer to make these changes.

There are two general types of languages—low-level and high-level. Low-level languages are similar to a computer's internal binary language, or machine language. They are difficult for humans to use and cannot be used interchangeably on different types of computers, but they produce the fastest programs. High-level languages are less efficient but are easier to use because they more closely resemble spoken or mathematical languages.

A computer «understands» only one language—patterns of 0s and 1s. For example, the command to move the number 255 into a CPU register, or memory location, might look like this: 00111110 11111111. A program might consist of thousands of such operations. To simplify the procedure of programming computers, a low-level language called assembly language assigns a mnemonic code to each machine-language instruction to make it easier to remember and write. The above binary code might be written in assembly language as: MVI A,0FFH. To the programmer this means «MoVe Immediately to register A the value 0FFH.» (The 0FFH represents the decimal value 255.) A program can include thousands of these mnemonics, which are then assembled, or translated, into the computer's machine language.

High-level languages use easily remembered commands, such as PRINT, OPEN, GOTO, and INCLUDE, and mathematical notation to represent frequently used groups of machine-language instructions.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. Look through the text and define which of the following keywords are mentioned in it.

file system	high-level languages	machine language
multiprocessing	switches	

Exercise 3. In what context are the proper names and numerals from Exercise 1 mentioned?

Exercise 4. Are the following statements true or false?

1. On the first mechanical computers, programmers had to reset switches and rewire computer panels in order to make changes in programs.
2. Now the computer makes changes in programs.
3. Low-level languages may be used interchangeably on different types of computers.
4. High-level languages are easier to use because they are the same as spoken languages.
5. Assembly language simplifies the procedure of programming computers.
6. Assembly language assigns a binary code to each machine-language instruction.
7. Mnemonics are then translated into the computer's machine language.

Exercise 5. Answer the following questions:

1. What did programmers have to do if they wanted to make changes in programs on the first electronic computers?
2. How many general types of programming languages are there?
3. Which language is similar to binary language?
4. Why is high-level language easier to use than low-level?
5. What will the command to move the number 255 into a CPU register look like in binary language?
6. What does the assembly language do to simplify the procedure of programming computers?
7. What is a high-level language?

Exercise 6. Match the word or phrase with its definition.

1. reset — a. a code for programming a computer that is a close approximation of machine language but is more easily understood by humans

2. switch — b. a set of characteristics that are displayed repeatedly

3. low-level language	c. something assisting or intended to assist memory
4. high-level languages	d. an order given
5. interchangeably	e. to make simple or simpler
6. efficient	f. a computer language such as machine code or assembly language that is closer to the form a computer understands than to that of the human language
7. pattern	g. a programming language closer to human language than low-level computer languages such as machine code or assembly language
8. simplify	h. to set again or anew
9. assembly language	i. capable of producing desired results especially without waste
10. mnemonic	j. instead of each other
11. command	
12. frequently	

Part 3
Systems software

A computer's operating system (OS) is the systems software that allows all the dissimilar hardware and software components to work together. It consists of a set of programs that manages all the computer's resources, including the data in main memory and in auxiliary storage. An OS provides services that are needed by applications and software, such as reading data from a hard disk. Parts of an OS may be permanently stored in a computer's ROM.

Computers write data to, and read from, auxiliary storage in collections called files. The file system of an OS allows programs to give names to files, and it keeps track of each file's location. A file system can also group files into directories or folders.

An OS allows programs to run. When a program is running, it is in the process of instructing the computer. For example, when a user plays a video game, the video-game program is running. An OS manages processes, each of which consists of a running program and the resources that the program requires. An advanced OS supports multiprocessing to enable several programs to run simultaneously. It may also include networking services that allow programs running on one computer to communicate with programs running on another.

Modern operating systems provide a graphical user interface (GUI) to make the applications software easier to use. A GUI allows a computer user to work directly with an application program by manipulating text and graphics on the monitor screen through the keyboard and a pointing device such as a mouse rather than solely through typing instructions on command lines. The Apple Computer company's Macintosh computer, introduced in the mid-1980s, had the first commercially successful GUI-based software.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. Look through the text and define which of the following keywords are mentioned in it.

binary language file system folder graphical user interface microchips

Exercise 3. In what context are the proper names and numerals from Exercise 1 mentioned?

Exercise 4. Are the following statements true or false?

1. An operating system consists of a set of programs that manages the data in main memory and in auxiliary storage.
2. An operating system provides services that are used neither by applications nor software.
3. An operating system keeps track of each file's location.
4. A file system groups files into directories, and directories are grouped into folders.
5. An operating system manages processes consisting of a running program and the resources that it requires.
6. Any operating system supports multiprocessing to enable several programs to run simultaneously.
7. A graphical user interface allows a computer user to work directly with an application program by typing instructions on command lines.

Exercise 5. Answer the following questions:

1. What is an operating system needed for?
2. What does an operating system consist of?
3. What is a file system and what can it do?
4. What is happening when a program is running?
5. What can an advanced operating system do?
6. What is a GUI and what is its function?
7. What company introduced the first commercially successful GUI-based software?

Exercise 6. Match the word or phrase with its definition.

1. operating system	a. information in numerical form for use in a computer
2. dissimilar	b. available to provide something extra or additional when needed
3. resources	c. software that simplifies the use of a computer especially by using icons and menus
4. data	d. a collection of data considered as a unit
5. application	e. a game played with images on a video screen
6. auxiliary	f. a usable stock or supply (as of money, products, or energy)
7. file	g. software that controls the operation of a computer and directs the processing of the user's programs (as by controlling input and output functions)
8. track	h. a computer program that performs one of the major tasks for which a computer is used
9. video game	i. different
10. graphical user interface	j. to write with a keyboard
11. text	
12. type	

<u>Unit 4. Manufacturers</u>

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. The success of the Macintosh prompted other manufacturers and software companies to create their own graphical user interfaces.
b. The Apple Macintosh, introduced in 1984 by Apple Computer, was the first popular microcomputer with a graphical user interface.
c. The success of PCs running Microsoft's Windows 3, launched in 1990, put pressure on Apple and the arrival of Windows 95 started Apple's decline.
d. Most notable of these are Microsoft Windows, which runs on IBM PC-compatible microcomputers, and OSF/Motif, from the Open Software Foundation, which is used with many UNIX systems.

Exercise 2. Fill in the gaps with the words from the box and read the whole paragraph.

backed backing behemoth cheaper enabling founders licensing marketing strategy

In 1977, Apple's (1) … Steve Jobs and Steve Wozniak received (2) … from a rich venture capitalist, Mike Markkula, who (3) … the production of the Apple II. Apple's early market lead in personal computing was destroyed by the entry of the computer industry's (4) … , IBM in 1981. Apple's imaginative response - the Macintosh, launched 1984 – was a proprietary design and was never able to gain enough market share to compete with thousands of firms making computers (5) … with IBM 's PCs. In 1994 Apple licensed the Macintosh for the first time, thus (6) … other manufacturers to make (7) … machines, the first appearing 1996. Unfortunately Apple proved unable to compete and reversed its licensing (8) …, buying its license back from Power Computing, and leading Motorola to leave the clone business in 1997.

Exercise 3. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1. not/Apple's/is/assured/long term/future.
2. However/industries/for these applications/following /the Macintosh/a very strong/in the creative world/particularly/the most popular software/and the multimedia/thanks to/in the publishing/of/and the availability/still has/its ease of use.
3. Apple/invested/In/in/Microsoft/$150 million/1997.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word or phrase with its definition.

1. graphical user interface	a. an undertaking involving chance, risk, or danger; a speculative business enterprise
2. prompt	b. to make a start
3. run on	c. to lay out money so as to return a profit
4. UNIX	d. something of monstrous size or power
5. backing	e. to lead to do something
6. venture	f. financial support
7. behemoth	g. to operate
8. launch	h. a popular multi-user multitasking operating system originally designed for mainframe computers

9. market share	i. software that simplifies the use of a computer especially by using icons and menus
10. compatible	j. capable of existing together in harmony
11. publishing	
12. invested	

(adopted from «Macintosh.» The Hutchinson Educational Encyclopedia on CD-ROM, 1999.)

Part 2
IBM

International Business Machines (IBM) is a multinational company, the largest manufacturer of computers in the world. The company is a descendant of the Tabulating Machine Company, formed in 1896 by US inventor Herman Hollerith to exploit his punched-card machines. It adopted its present name in 1924. IBM became an important patron of modern design in the post-1945 years. By 1991 it had an annual turnover of $64.8 billion and employed about 345,000 people, but in 1992 and 1993 it lost billions of dollars and shed almost half its 420,000 staff. The company acquired Lotus Development Corporation in 1995. By 1997 IBM had, under new management, recovered financially, with an annual turnover of $76 billion, which means it is still a dominant industry player. Its acquisition of the Lotus Development Corporation gave IBM access to its wide range of innovative software, including the 1-2-3 spreadsheet and Notes, a market leader in groupware.

Founded in 1924, by former cash register salesman Tom Watson, IBM grew to monopolize the mechanical data processing business, and in the 1950s, thanks mainly to Tom Watson Jr, quickly took over the new electronic (computer-based) data processing business, too.

IBM's sales increased from $734 million in 1956 to $51 billion in 1986, when the company dominated most computer markets: mainframes, minicomputers, personal computers and networking. However, the rise of powerful microprocessors and the `open systems´ movement destroyed much of IBM's power.

(adopted from «IBM.» The Hudchinson Educational Encyclopedia on CD-ROM, 1999.)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. Look through the text and define which of the following keywords are mentioned in it.

anticompetitive behaviour	design	IBM	Internet browsers	software

Exercise 3. In what context are the proper names and numerals from Exercise 1 mentioned?

Exercise 4. Are the following statements true or false?
1. IBM is the largest manufacturer of computers in the world.
2. The company was named IBM in 1896.
3. In 1992 and 1993 it employed about 345,000 people.
4. New management made the company recover financially by 1997.
5. Its acquisition of the Lotus Development Corporation was a big mistake.
6. First the company monopolized the mechanical data processing business, and then electronic data processing business.
7. Now most of IBM's power is destroyed.

Exercise 5. Answer the following questions:
1. What company was founded in 1896?
2. When IBM had the most power of its history?
3. When did the crisis of IBM happen?
4. When and why did it recover financially?
5. What did IBM benefit from its acquirement of Lotus Development Corporation?
6. Who and when founded IBM?
7. Why is now much of IBM's power destroyed?

Exercise 6. Match the word or phrase with its definition.

1. multinational	a. having great influence over all others
2. manufacturer	b. one coming directly from an earlier and usually similar type
3. descendant	c. a person chosen as a special supporter
4. exploit	d. to accept formally
5. adopt	e. to make use for one's own advantage
6. patron	f. the people who manage
7. annual	g. having divisions in more than two countries
8. turnover	h. software where anyone is free to take a copy of the course code and extend develop or fix bugs in it
9. management	i. to acquire or have complete control over
10. dominant	j. the purchase, sale, and replacement of a stock of goods
11. monopolize	
12. `open system´	

Part 3

Microsoft

Microsoft is a US corporation, now the world's largest software supplier. Microsoft's first major product was a version of Basic, written for the MITS Altair 1975, and adopted by most of the desktop computer industry. Through MS-DOS, written for IBM, Windows, and related applications it has steadily increased its hold on the personal computer market. Microsoft was founded by Bill Gates and Paul Allen in 1975.

Together with Intel, the company supplied operating systems and computer chips for about 90% of the world's personal computers in 1997. In 1996, Microsoft launched another new operating system, Windows CE (Consumer Electronics), for handheld computers, pen-operated personal digital assistants, in-car systems and similar applications. Suppliers of CE-based HPCs (handheld personal computers) include Casio, Compaq, Hewlett-Packard, Philips and Sharp. Windows CE version 2 is also used in an improved version of WebTV: a set-top box that enables users to surf the Internet on their television sets. Microsoft purchased WebTV Networks for $425 million in 1997. The first companies to supply WebTV systems were Philips, Sony and Mitsubishi.

In 1990-1993 Microsoft was charged with engaging in anticompetitive behaviour. Under a settlement reached in 1994, Microsoft agreed to end the uncompetitive practice `per processor´ pricing, whereby PC manufacturers paid a fee for each machine produced irrespective of the software to be installed. The Justice Department started another case in 1997, accusing Microsoft of breaking this settlement by tying the installation of Windows 95 to the installation of Microsoft's free Web browser, Internet Explorer. In May 1998 Microsoft was accused of abusing its monopoly power against Netscape, its main competitor in Internet browsers.

(adopted from «Microsoft.» The Hutchinson Educational Encyclopedia on CD-ROM, 1999.)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. Look through the text and define which of the following keywords are mentioned in it.

handheld computers	monopoly	multinational company
operating system	punched-card machines	

Exercise 3. In what context are the proper names and numerals from Exercise 1 mentioned?

Exercise 4. Are the following statements true or false?

1. Microsoft now supplies the most part of the software in the world.
2. Microsoft's version of Basic was adopted by most of the desktop computer industry.

3. In 1997 the company alone supplied operating systems and computer chips for about 90% of the world's personal computers.
4. Windows CE was designed for desktop computers.
5. WebTV enables users to access to the Internet on their television sets.
6. In 1994 Microsoft was made to end its anticompetitive behaviour.
7. In May 1998 Microsoft broke this settlement.

Exercise 5. Answer the following questions:

1. What was Microsoft's first major product?
2. What Microsoft operating systems are mentioned in the text?
3. What devices use Windows CE?
4. What companies are the suppliers of CE-based handheld personal computers?
5. What is WebTV?
6. What did Microsoft promise to do in the agreement of 1994?
7. How did Microsoft break this agreement?

Exercise 6. Match the word or phrase with its definition.

1. supplier	a. to make able
2. major	b. to browse webpages on the Internet in an unplanned way
3. adopt	c. notable in effect or scope
4. hold	d. a question or claim to be settled in a court of law
5. handheld	e. to accuse formally
6. pen-operated	f. to use excessively
7. enable	g. full or immediate control
8. surf	h. having a pen input device instead of a keyboard
9. purchase	i. to take as one's own
10. charge	j. designed to be used while being held in the hand
11. case	
12. abuse	

Unit 5. The Internet

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. Once in the computer, the information is categorized and cross-indexed.
b. Organizations that have large amounts of printed information, such as major

libraries, universities, and research institutes, are working to transfer their information into databases.

c. The advent of the Internet and the World Wide Web caused a revolution in the availability of information not seen since the invention of the printing press.
d. Many people purchase home computers so they can access the Web in the privacy of their homes.
e. This revolution has changed the ways many people access information and communicate with each other.
f. When the database is then put onto a Web server, users can access and search the information using the Web, either for free or after paying a fee.

Exercise 3. Fill in the gaps with the words from the box and read the whole paragraph.

access	alternative	broadcast	digital	information	newsagency
organizations	organizations	recorded	server		

The information superhighway, as the Internet is sometimes called, provides (1) … to live, instantaneous information from a variety of sources. People with (2) … cameras can record events, send the images to a Web (3) … , and allow people anywhere in the world to view the images almost as soon as they are (4) …. Many major newsgathering (5) … have increased their use of the Web to (6) … their stories. Smaller, independent news sources and (7) … , which may not be able to afford to broadcast or publish in other media, offer (8) … coverage of events on the Web.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1. People/ messages / or / with each other / to communicate / live conversations / the information superhighway / through e-mail/ personal Web pages» /where /individuals/ throughout the world /can type /to carry on/can use/Internet «chat rooms.
2. for/is/almost/sharing information/opinions/The potential/limitless/and.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word or phrase with its definition.

1.	advent	a.	to put into a category
2.	the Internet	b.	being one of the things between which a choice is to be made
3.	communicate	c.	to make widely known
4.	major	d.	a camera that records images as digital data instead of on film
5.	categorize	e.	a set charge
6.	cross-index	f.	a communications system that connects computers and computer networks all over the world
7.	fee	g.	to transmit information, thought, or feeling so that it is satisfactorily received or understood
8.	superhighway	h.	the first appearance
9.	digital camera	i.	significant in size, amount, or degree
10.	image	j.	a highway designed for high-speed traffic
11.	broadcast		
12.	alternative		

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2
The Internet explosion

Perhaps no single technical advance has had such a broad impact on business, education, and culture as the Internet, a vast computer network accessed by millions of users around the world. The Internet has transformed the way people communicate by enabling millions of subscribers to send mail and access information instantly.

What began in 1970 as a network of computers supported by the United States Department of Defense quickly grew in the late 1980s and 1990s to include universities, federal agencies, businesses, and individuals. One Internet application in particular, the World Wide Web, attracted users with its ease of use and expanse of information.

As its popularity has grown, the Internet has become the backbone of the modern, information-driven economy. It has been a major force behind the globalization of business, giving companies a new way to connect with existing and potential customers around the world. The Internet has also become a major source of «infotainment» for young and older people alike, allowing them to chat with other users and find resources on every hobby and interest imaginable.

While the Internet has proven to be an invaluable source for educational information, it also is a method for disseminating pornography and other «indecent» material. Although no single authority regulates the Internet, numerous legislative initiatives have targeted it for censorship. As Internet use became increasingly widespread in subsequent years, regulation remained a frequent topic of debate.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numbers.

Exercise 2. Look through the text and define which of the following keywords are mentioned in it.

censorship	download	globalization	network	Web sites

Exercise 3. In what context are the proper names and numbers from Exercise 1 mentioned?

Exercise 4. Are the following statements true or false?

1. The Internet has had the broadest impact on business, education, and culture compared with other technical advances.
2. The Internet began in 1970 as a network of computers supported by the United States Department of Defense.
3. From the very beginning the Internet included universities, federal agencies, businesses, and individuals.
4. The World Wide Web is one of the Internet applications.
5. The Internet has speeded up the globalization of business.
6. The Internet has become a major source of «infotainment» for young people only.
7. The Internet has proven to be an invaluable source of always reliable information.

Exercise 5. Answer the following questions:

1. What had the Internet have the impact on?
2. How has the Internet transformed the way people communicate?
3. When did the Internet advent?
4. What did the popularity of the Internet bring?
5. What is «infotainment»?
6. Why is the Internet a source of «indecent» material?
7. What remained a frequent topic of debate concerning the Internet?

Exercise 6. Match the word or phrase with its definition.

1. technical advance	a. the system or practice of censoring
2. impact	b. informational and entertaining
3. vast	c. having value too great to be estimated
4. subscriber	d. a forceful effect
5. backbone	e. to take part in an online discussion in a chat room
6. globalization	f. not decent or proper
7. customer	g. one who receives a periodical or service regularly on order
8. infotainment	h. very great in extent, size, amount, degree, or intensity
9. chat	i. one that buys a product or service
10. invaluable	j. the foundation or sturdiest part of something
11. indecent	
12. censorship	

Part 3

World Wide Web

British physicist Tim Berners-Lee invented the World Wide Web in 1992 as a way to organize and access information on the Internet. Its introduction caused the popularity of the Internet to explode nearly overnight. Instead of being able to download only simple linear text, with the introduction of the World Wide Web users could download Web pages that contain text, graphics, animation, video, and sound. A program called a Web browser runs on users' PCs and workstations and allows them to view and interact with these pages.

Many commercial companies maintain Web sites, or sets of Web pages, that their customers can view. The companies can also sell their products on their Web sites. Customers who view the Web pages can learn about products and purchase them directly from the companies by sending orders back over the Internet. Buying and selling stocks and other investments and paying bills electronically are other common Web activities.

Many organizations and educational institutions also have Web sites. They use their sites to promote themselves and their causes, to disseminate information, and to solicit funds and new members. Some political candidates, for example, have been very successful in raising campaign funds through the Internet. Many private individuals also have Web sites. They can fill their pages with photographs and personal information for viewing by friends and associates.

Web sites are maintained on computers called Web servers. Most companies and many organizations have their own Web servers. These servers often have databases that store the content displayed on their sites' pages. Individuals with Web sites can use the Web servers of their Internet service providers.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numbers.

Exercise 2. Look through the text, and define which of the following keywords are mentioned in it.

censorship	commercial companies	customers	subscribers	Web site

Exercise 3. In what context are the proper names and numbers from Exercise 1 mentioned?

Exercise 4. Are the following statements true or false?

1. The World Wide Web was invented in 1992 as a way to organize and access information on the Internet.
2. Users with the help of the World Wide Web could download simple linear text.
3. A Web browser allows users to view and interact with Web pages.
4. Customers can learn about products and purchase them directly from the companies by sending orders over the Internet, but cannot buy and sell stocks and other investments and paying bills.
5. Many organizations successfully use their sites to promote themselves and their causes, to disseminate information, and even to solicit funds and new members.
6. Many private individuals have Web servers rather than use the Web servers of their Internet service providers.
7. Web servers often have databases that store the content displayed on their sites' pages.

Exercise 5. Answer the following questions:

1. Who invented the World Wide Web?
2. How did the World Wide Web change the Internet?
3. What allows users to view and interact with Web pages?
4. What can customers do over the Internet?
5. What do organizations and educational institutions use their Web sites for?
6. What can private individuals use their Web sites for?
7. What is the Web server and what does it contain?

Exercise 6. Match the word or phrase with its definition.

1. download	a. to help grow or develop
2. linear	b. to keep in an existing state
3. animation	c. a computer in a network that is used to provide services (as access to files or the delivery of e-mail) to other computers
4. interact	d. to spread around as if sowing seed
5. maintain	e. to approach with a request or appeal
6. order	f. the ownership element of a corporation divided to give the owners an interest and usually voting power
7. stock	g. to transfer data from a large computer to the memory of another device (as a smaller computer)
8. promote	h. a film made by photographing a series of positions of objects (as puppets)
9. disseminate	i. to act on one another
10. solicit	j. a sum of money for a special purpose
11. fund	
12. server	

Unit 6. Data Security

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. But after the programs are completed, they are stored on relatively inexpensive media such as CD-ROMs that can be easily copied.
b. The software industry loses billions of dollars each year to piracy.
c. Software companies and their programmers can spend many years and millions of dollars developing their programs.
d. Computer software is often much more expensive than the computer hardware that it runs on.
e. A software pirate is a person or a company that uses a copy of a program that was not purchased legitimately.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1. to break/or/Some criminals/in order to/some damage /use/or other computer networks/a particular computer system/the Internet/into/access/forbidden information/to cause.
2. are/Such/called/users/also/hackers.
3. Many companies/use/from/that/and organizations/to protect/have/various security measures/such as/computers serving as firewalls/their computers/networked computers/illegitimate access.
4. and/how/them/are familiar/know/many hackers/these measures/to get around/with/But.

Exercise 3. Fill in the gaps with the words from the box and read the whole paragraph.

databases	hacker	hackers	hackers	information	information
other	others	otherwise	use	used	

Some (1) … are bent on sabotage, and (2) … are interested in stealing (3) … from the computers they break into. Many (4) …, however, do it simply for the challenge of gaining access to (5) … inaccessible (6) …. Computers at government and military institutions are therefore often targets. Another motivation for criminals to break into government and corporate (7) … is identity theft—the unauthorized (8) … of an individual's personal information, such as social security number and credit card account numbers. This information might be (9) … for theft or to conceal the criminal's own identity.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word or phrase with its definition.

1. hacker	a.	a goal to be achieved
2. firewall	b.	to hide from sight
3. forbidden	c.	computer hardware or software that limits access by outside users on a network
4. account	d.	a collection of data that is organized especially to be used by a computer
5. database	e.	a sum of money deposited in a bank
6. conceal	f.	can not be done or used
7. purchase	g.	the use of another's production or invention without permission
8. expensive	h.	a person who illegally gains access to a computer system
9. piracy	i.	an invitation or dare for someone to compete in a contest or sport
10. bent on	j.	to get by paying money for
11. challenge		
12. target		

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2
Cybercrime

Computers, with all the benefits they offer, also unfortunately can enable cybercrime, or computer crime. Of course, the computers and their electronic components have always been the targets of thieves. But with the decreasing cost of hardware and the increasing value of software and information, criminals have begun to concentrate on the latter. Law-enforcement agencies throughout the world have had to learn ways to combat computer crime.

Criminals can log into the Internet just like everyone else, and they can commit crimes against other people who also are logged in. They may give out false information to encourage others to send them money or personal information. They may also be predators who use the anonymity afforded by chat rooms and discussion groups to lure children into meeting them in person.

In an effort to sabotage other people's computers, malevolent computer programmers (sometimes called hackers) create software that can manipulate or destroy another computer's programs or data. The most common of such malicious programs are called viruses. A computer virus infects, or secretly runs on, a computer to cause some mischief or damage. It can attach itself to a legitimate program, often in the computer's operating system, and then copy itself onto other programs with which it comes in contact. Worms are self-contained programs that enter a computer and generate their own commands. Viruses and worms can spread from one computer to another by way of exchanged disks, over local area networks, or over the Internet. If undetected, they may be powerful enough to cause computer systems to crash or even shut down large portions of the Internet.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text, and define which of the following keywords are mentioned in it.

computer crime	court	hackers	industrial espionage	malicious programs

Exercise 2. Are the following statements true or false?

1. Viruses never affect legitimate programs.
2. Nowadays criminals concentrate on stealing software.
3. Viruses and worms can shut down large portions of the Internet.
4. Criminals can commit crimes against other people who are logged off.
5. Worms can be spread from one computer to another over the Internet.
6. Law-enforcement agencies always know how to combat computer crime.
7. Viruses are self-contained programs that enter a computer and generate their own commands.

Exercise 3. Answer the following questions:

1. What is a cybercrime?
2. When can criminals commit crimes against other people on the Internet?
3. What do hackers give out false information for?
4. What can malicious programs do?
5. Where can viruses and worms attach themselves?
6. What provides anonymity?
7. What is the difference between viruses and worms?

Exercise 4. Match the word or phrase with its definition.

1. benefit	a. to tempt or lead away by offering some pleasure or advantage
2. crime	b. the quality or state of being anonymous
3. log into	c. having or showing ill will
4. predator	d. to become copied to
5. anonymity	e. software that controls the operation of a computer and directs the processing of the user's programs (as by controlling input and output functions)
6. lure	f. to make a connection with a computer or network
7. malevolent	g. an animal that lives by killing and eating other animals
8. infect	h. lawful
9. run on	i. something that does good to a person or thing; useful aid
10. legitimate	j. the doing of an act forbidden by law or the failure to do an act required by law especially when serious
11. operating system	
12. undetected	

Part 3
Industrial Espionage

On June 22, 1982, the United States Justice Department charged 18 Japanese executives with conspiring to steal computer secrets from International Business Machines (IBM) Corporation. The executives were employees of Hitachi, Ltd., and of Mitsubishi Electric Corporation. The operation was uncovered through a Federal Bureau of Investigation (FBI) «sting» operation. An FBI agent posed as a seller of the information. When the executives tried to pay for the data, they were apprehended. A year later the affair was settled out of court by an apology from the offenders and a substantial payment to IBM, a payment estimated to be 300 million dollars.

Today's technology makes possible the introduction of more than a half million new products into the world market every year. When a new product is introduced by a company, competitors are immediately at a disadvantage and want to market something similar. Competitors are willing by fair means—and sometimes by foul—to obtain trade secrets and risk patent infringement.

Businesses threatened with industrial espionage and government installations where national security is an issue use personnel-screening devices to keep out or restrict unauthorized individuals. There are access-control systems

that «read» voice characteristics and hand geometry. Sometimes employees are required to wear distinctive badges or identification tags in order to gain access to otherwise restricted areas. Some badges are designed to activate electronic door controls. There are also surveillance devices to scan premises at night, infrared cameras to take pictures in the dark, and equipment to survey considerable distances, making surreptitious approach to the premises difficult.

(adopted from «espionage.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)
(adopted from «security system.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following keywords are mentioned in it.

anonymity	offender	personnel-screening devices	trade secrets	virus

Exercise 2. Are the following statements true or false?

1. On June 22, 1982, the United States Justice Department charged 18 Japanese executives working for International Business Machines.
2. An FBI agent pretended to be a seller of the information
3. When a new product is introduced by a company, competitors try to market a different innovation.
4. Nevertheless, competitors don't risk patent infringement.
5. Personnel-screening devices are used to prevent unauthorized access.
6. Employees are required to wear badges or identification tags in order to gain access even to public areas.
7. The badges are designed to activate electronic door controls.

Exercise 3. Answer the following questions:

1. Who was trying to buy the information on June 22, 1982?
2. How many new products can be introduced into the world market every year?
3. What do companies want to do when their competitor markets something new?
4. Which companies prefer to use personnel-screening devices and why?
5. What can badges and identification tags be used for?
6. What access-control equipment is mentioned in the text?
7. What other devices are mentioned in the text?

Exercise 4. Match the word with its definition.

1. executive	a. to look over and examine closely
2. apprehend	b. done, made, or acquired in secret

3.	competitor	c.	a person who manages or directs
4.	foul	d.	created for a specific function or end
5.	obtain	e.	arrest
6.	restrict	f.	to gain or acquire usually by planning or effort
7.	geometry	g.	one that competes especially in the selling of goods or services
8.	badge	h.	shape
9.	designed	i.	very unfair
10.	surveillance	j.	to place under limits as to use limit
11.	survey		
12.	surreptitious		

Unit 7. The Future of Computers

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. With many processors simultaneously working on a given task, the problem can be solved much more quickly.
b. Many researchers feel that the future of computer hardware might not be in further miniaturization, but in radical new architectures, or computer designs.
c. Massively parallel computers—consisting of hundreds of small, simple, but structurally linked microchips—break tasks into their smallest units and assign each unit to a separate processor.
d. For example, almost all of today's computers process information serially, one element at a time.

Exercise 2. Fill in the gaps with the words from the box and read the whole paragraph.

breakthrough	circuit	hardware	integration	microprocessors
software	transfer	transistor	wafer	

A major technology (1) … was made in 2003 by Sun Microsystems, Inc. While the integrated (2) … has enabled millions of transistors to be combined in one manufacturing process on a silicon chip, Sun has taken the next step to wafer-scale (3) …. Rather than producing hundreds of (4) … on each silicon wafer, cutting them into separate chips, and attaching them to a circuit board, Sun figured out how to manufacture different chips edge-to-edge on a single (5) …. When introduced into full-scale manufacturing, this process promises to

eliminate circuit boards, speed up data (6) … between different elements by a hundredfold, and substantially reduce the size of computer (7) ….

Exercise 3. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1. Two/and/quantum mechanics/exotic/involve/biological genetic material/computer research directions/the principles of/the use of.
2. In/used to gradually/with/to a problem/millions of strands of DNA/DNA computing/are used/various chemical methods/winnow out/false solutions/to test possible solutions.
3. DNA computing/however/before/have already shown/need to be developed/Demonstrations on/routing schedules/great promise/more efficient/laboratory techniques/finding/the most efficient/becomes practical.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word or phrase with its definition.

1.	researcher	a.	the general specification of a system
2.	miniaturization	b.	to sort or separate as if by winnowing
3.	architecture	c.	a tendency to design or construct everything in small size
4.	parallel	d.	at the same time
5.	simultaneously	e.	to increase the speed of
6.	integrated circuit	f.	any of various nucleic acids that are located especially in cell nuclei, are usually the chemical basis of heredity, and are composed of two nucleotide chains held together by hydrogen bonds in a pattern resembling a flexible twisted ladder
7.	wafer	g.	a thin crisp cake or cracker
8.	integration	h.	a tiny group of electronic devices and their connections that is produced in or on a small slice of material (as silicon)
9.	speed up	i.	to get rid of
10.	eliminate	j.	being or relating to a connection in a computer system in which the bits of a byte are transmitted over separate wires at the same time
11.	DNA		
12.	winnow		

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Software developments

As exciting as all the hardware developments are, they are nevertheless dependent on well-conceived and well-written software. Software controls the hardware and forms an interface between the computer and the user. Software is becoming increasingly user-friendly (easy to use by nonprofessional computer users) and intelligent (able to adapt to a specific user's personal habits). A few word-processing programs learn their user's writing style and offer suggestions; some game programs learn by experience and become more difficult opponents the more they are played. Future programs promise to adapt themselves to their user's personality and work habits so that the term personal computing will take on an entirely new meaning.

Programming is itself becoming more advanced. While some types of programming require even greater expertise, more and more people with little or no traditional computer programming experience can do other forms of programming. Object-oriented programming technology, in conjunction with graphical user interfaces, will enable future users to control all aspects of the computer's hardware and software simply by moving and manipulating graphical icons displayed on the screen.

Another approach to programming is called evolutionary computation for its use of computer code that automatically produces and evaluates successive «generations» of a program. Short segments of computer code, called algorithms, are seeded into an artificial environment where they compete. At regular intervals, the algorithms deemed best according to user-supplied criteria are harvested, possibly «mutated,» and «bred.» Over the course of thousands, or even millions, of computer generations, highly efficient computer programs have been produced. Thus far, the need to carefully devise «survival» criteria for the genetic algorithms has limited the use of this technique to academic research.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key-words are mentioned in it.

computer security	independent consultants	interface
object-oriented programming	word-processing	

Exercise 2. Are the following statements true or false?

1. Software is steadily becoming less user-friendly and intelligent.
2. A few word-processing programs can understand their user's handwriting.
3. Some game programs become more experienced and more difficult opponents the more they are played.
4. Today you can't do any forms of programming with little or no traditional computer programming experience.

5. With the help of object-oriented programming technology, users will be able to control the computer's hardware and software by moving and manipulating graphical icons displayed on the screen.
6. The algorithms are placed into an artificial environment where some of them are then harvested, possibly «mutated,» and «bred».
7. Evolutionary computation has been widely used for academic research thanks to «survival» criteria for the genetic algorithms.

Exercise 3. Answer the following questions:

1. What do hardware developments depend on?
2. What is the main tendency in the use of software nowadays?
3. What will future programs do?
4. How will future users control all aspects of the computer's hardware and software?
5. What is evolutionary computation?
6. What algorithms are seeded into an artificial environment for?
7. What is the influence of «survival» criteria on evolutionary computation?

Exercise 4. Match the word or phrase with its definition.

1. exciting	a. a type of programming where programs are made from combinations of predefined modules that can be used over and over again
2. interface	b. a pictorial symbol on a computer screen
3. user-friendly	c. the design and production of computer programs
4. word-processing program	d. the ways by which interaction or communication between a computer and a user is brought about
5. programming	e. careful study and investigation for the purpose of discovering and explaining new knowledge
6. adapt	f. a type of computer application program used for typing and and editing text documents
7. object-oriented programming	g. any of the parts into which a thing is divided or naturally separates
8. icon	h. to change so as to fit a new or specific use or situation
9. conjunction	i. causing excitement
10. segment	j. a joining together
11. mutate	
12. research	

Part 3

Careers in the Computer Field

The information technology (IT) sector experienced tremendous growth in the late 20th century. By the early 21st century, computer-related jobs employed millions of people around the world.

Not all computer professionals work directly for a company. Many are independent consultants who are hired to accomplish a specific task and are paid by the hour. A consulting job may last from a few hours to several years.

Systems analysts develop methods for computerizing businesses and scientific centers. They and computer consultants also improve the efficiency of systems already in use. Computer-security specialists help protect the integrity of the huge information banks developed by businesses and governments.

Applications programmers write commercial programs to be used by businesses and other organizations as well as in the home. Systems programmers write the complex programs that control the inner workings of the computer. Many specialty areas exist within these two large groups, such as database programmers and designers of graphical user interfaces.

As more small- and medium-sized businesses have become computerized, they have required more people to operate their systems. Computer operators and systems administrators typically need to handle several types of computers and be familiar with a diversified range of applications and systems software. Companies also need specialists to administer their Web sites.

Other important careers in the IT field include computer scientists, who perform research and teach at universities, and hardware designers and engineers, who work in areas such as microchip and peripheral equipment design. Information-center or database administrators manage the information collections developed by businesses or data banks.

(adopted from «computer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following keywords are mentioned in it.

database programmers	evolutionary computation	hardware designers
independent consultants	object-oriented programming	

Exercise 2. Are the following statements true or false?

1. The growth in the information technology sector started in the 21st century.
2. Independent consultants are hired by companies for a period from few hours to several years to accomplish a specific task and are paid by the hour.

3. Systems analysts are the only specialists who improve the efficiency of systems already in use.
4. Applications programmers write commercial programs not only for businesses but also for home use.
5. Applications programmers write the complex programs that control the inner workings of the computer.
6. When small- and medium-sized businesses become computerized, they require less people to operate their systems.
7. Computer scientists, who perform research and teach at universities, and hardware designers and engineers, who work in areas such as microchip and peripheral equipment design are also important careers in the IT field.

Exercise 3. Answer the following questions:

1. How many people had computer-related jobs by the early 21st century?
2. How are independent consultants paid?
3. What do systems analysts do?
4. How do the huge information banks developed by businesses and governments protect their integrity?
5. Who writes the complex programs that control the inner workings of the computer?
6. What is the function of computer operators and systems administrators?
7. What are other important careers in the IT field?

Exercise 4. Match the word or phrase with its definition.

1. tremendous	a. the condition of being free from damage or defect
2. independent consultant	b. a person who specializes in writing systems software such as operating system programs
3. systems analyst	c. a large collection of data that can be accessed by many users and enables them to copy or store data on a particular topic
4. computer consultant	d. a person who designs or modifies information systems to meet users' requirements
5. computer-security specialist	e. a person whose job is to operate part of a computer system
6. integrity	f. a specialist not belonging to any company who gives professional advice or services
7. applications programmer	g. a person who maintains a multi-user computer system
8. systems programmer	h. a person who writes applications programs using a computer language

9. computer operator
10. system administrator
11. hardware designer
12. data bank

i. a person who is paid to advise on computing system issues
j. astonishing because of great size, excellence, or power

6. READING ROOM FOR STUDENTS OF NANO- AND BIOMEDICAL TECHNOLOGIES

Unit 1. Quality Control

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. Since its initial release, a second release was made in 2005 after it was agreed that it needed to have its quality system words more closely aligned with the 2000 version of ISO 9001.
b. ISO/IEC 17025 is the main standard used by testing and calibration laboratories.
c. And it applies directly to those organisations that produce testing and calibration results.
d. There are many commonalities with the ISO 9000 standard, but ISO/IEC 17025 adds in the concept of competence to the equation.
e. Originally known as ISO/IEC Guide 25, ISO/IEC 17025 was initially issued by the ISO in 1999.

Exercise 2. Fill in the gaps with the words from the box.

with	itself	are	to	within	for	down	is	on	most

On 12th May 2005 the alignment work of the ISO committee responsible (1)… it was completed (2)… the issuance of the revised standard. The (3)… significant changes introduced greater emphasis (4)… the responsibilities of senior management, and explicit requirements for continual improvement of the management system (5)…, and particularly, communication with the customer. There (6)… two main sections in ISO/IEC 17025 - Management Requirements and Technical Requirements. Management requirements are primarily related (7)… the operation and effectiveness of the quality management system (8)…the laboratory. Technical requirements address the competence of staff, methodology and test/calibration equipment.

Exercise 3. Put the words and phrases of the given sentences into the proper order.

1. aimed at /Laboratories / to implement / a quality system / ISO/IEC 17025 / improving / to consistently produce / use / valid results their ability /.
2. also / is / accreditation from / It / an Accreditation Body the basis for /.
3. simply formal /about competence,/ a demonstration /accreditation / is / recognition of / of that competence / is / Since the standard /.
4. a laboratory / quality management system / A prerequisite for / is / to have / a documented / to become accredited /.
5. of /of / The usual contents / follow the outline / the ISO 17025 standard / the quality manual /.

Exercise 4. Look through the paragraphs above and give the title to the whole text

Exercise 5. Match the words or phrases with their definitions.

1. accreditation	a.	the set of different facts, ideas, or people that all affect a situation and must be considered together
2. standard	b.	happening at the beginning
3. issue	c.	having an important effect or influence, especially on what will happen in the future
4. equation	d.	expressed in a way that is very clear and direct
5. content	e.	he process of checking or slightly changing an instrument or tool so that it does something correctly
6. initial	f.	the ability to do something well
7. revise	g.	the level that is considered to be acceptable, or the level that someone or something has achieved
8. significant	h.	the people who are in charge of a company or organization
9. management	i.	to change something because of new information or ideas
10. explicit	j.	if an organization or someone in an official position issues something such as documents or equipment, they give these things to people who need them
11. competence		
12. calibration		

(adopted from «ISO/IEC 17025.» http://en.wikipedia.org/w/index.php?title=ISO/IEC_17025&oldid=163067654)

Part 2
Statistical Process Control

Statistical Process Control (SPC) is an effective method of monitoring a process through the use of control charts. By collecting data from samples at various points within the process, variations in the process that may affect the quality of the end product or service can be detected and corrected, thus reducing waste and as well as the likelihood that problems will be passed on to the customer. With its emphasis on early detection and prevention of problems, SPC has a distinct advantage over quality methods, such as inspection, that apply resources to detecting and correcting problems in the end product or service.

In addition to reducing waste, SPC can lead to a reduction in the time required to produce the product or service from end to end. This is partially due to a diminished likelihood that the final product will have to be reworked, but it may also result from using SPC data to identify bottlenecks, wait times, and other sources of delays within the process. Process cycle time reductions coupled with improvements in yield have made SPC a valuable tool from both a cost reduction and a customer satisfaction standpoint.

By observing at the right time what happened in the process that led to a change, the quality engineer or any member of the team responsible for the production line can troubleshoot the root cause of the variation that has crept in to the process and correct the problem. SPC indicates when an action should be taken in a process, but it also indicates when NO action should be taken.
(adopted from «statistical process control.» http://en.wikipedia.org/w/index.php?title=Statistical_process_control&oldid=16194919)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

Use of control charts	precious thing	end product
sources of delays	main problems	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following sentences true or false?

1. Statistical Process Control is an effective method of monitoring a product through the use of control charts.
2. Statistical Process Control has a distinct advantage over quality methods, such as inspection because of its emphasis on early detection and prevention of problems.
3. Statistical Process Control applies resources to detecting and correcting problems in the end product or service.
4. Statistical Process Control never leads to waste reduction.

5. Statistical Process Control is used to identify bottlenecks, wait times, and other sources of delays within the process.
6. Statistical Process Control is a valuable tool from both a cost reduction and a customer satisfaction standpoint.
7. The quality engineer is a professional who knows instinctively what the root problem is.

Exercise 4. Answer the following questions:
1. How does Statistical Process Control monitor a process of production?
2. What kinds of variations in the process are detected?
3. Why does Statistical Process Control have advantages over other quality methods?
4. What are the advantages of Statistical Process Control?
5. How is Statistical Process Control data used?
6. Why can Statistical Process Control lead to a reduction in the time required to produce the product or service from end to end?
7. Who troubleshoots variations in the process that may affect the quality of the end product or service?

Exercise 5. Match the words or phrases with their definitions.

1. chart	a. a delay in one stage of a process that makes the whole process take longer
2. data	b. the practice of checking goods as they are produced to be sure that their quality is good enough
3. to detect	c. the act of improving something or the state of being improved
4. bottleneck	d. Information that is clearly arranged in the form of a simple picture, set of figures, graph etc, or a piece of paper with this information on it
5. delay	e. the period of time needed for a machine to finish a process
6. cycle	f. the amount of profits, crops etc that something produces
7. improvement	g. a way of thinking about people, situations, ideas
8. standpoint	h. Information or facts
9. yield	i. when someone or something has to wait, or the length of the waiting time
10. valuable	j. to notice or discover something, especially something that is not easy to see, hear
11. troubleshoot	
12. quality control	

Part 3

Quality assurance

Quality assurance (QA) is the activity of providing evidence needed to establish confidence among all concerned, that quality-related activities are being performed effectively: all those planned or systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality. For products, quality assurance is a part and consistent pair of quality management proving fact-based external confidence to customers and other stakeholders that a product meets needs, expectations, and other requirements. QA assures the existence and effectiveness of procedures that attempt to make sure - in advance - that the expected levels of quality will be reached.

QA covers all activities from design, development, production, installation, servicing to documentation. It introduced the sayings «fit for purpose» and «do it right the first time». It includes the regulation of the quality of raw materials, assemblies, products and components; services related to production; and management, production, and inspection processes.

The term Quality Assurance, as used in the United States Nuclear Regulatory Commission regulation, comprises all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service. Quality assurance includes quality control, which comprises those quality assurance actions related to the physical characteristics of a material, structure, component, or system which provide a means to control the quality of the material, structure, component, or system to predetermined requirements.

(adopted from «Quality assurance.» http://en.wikipedia.org/w/index.php?title=Quality_assurance&oldid=166514820)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

quality assurance	quality management	Nuclear Regulatory Commission
accidental	to control	the quality of the material

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following sentences true or false?
1. Quality assurance is used to establish confidence among all sides interested, that quality-related activities are being performed effectively.
2. Quality-related activities are planned or systematic actions necessary to provide adequate confidence that a product or service will satisfy given requirements for quality.
3. Quality assurance proves that a product meets technical requirements only.

4. There are procedures that attempt to make sure that the expected levels of quality were reached.
5. The term Quality Assurance is used in the United Nations.
6. All planned and systematic actions are necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service.
7. Quality control is a part of quality assurance activities.

Exercise 4. Answer the following questions:
1. What is Quality assurance used for?
2. What does the term 'quality-related activities' comprise?
3. Who needs to be proved that a product meets needs, expectations, and other requirements?
4. What kind of procedures are assured to exist with the help of Quality assurance?
5. What kinds of activities does Quality assurance cover?
6. What sayings did Quality assurance introduce?
7. What actions does Quality assurance comprise?

Exercise 5. Match the words or phrases with their definitions.

1. adequate	a. relating to your environment or situation, rather than to your own qualities, ideas
2. quality assurance	b. someone who has invested money into something, or who has some important c. connection with it, and therefore is affected by its success or failure
3. external	c. when someone fits a piece of equipment somewhere
4. customer	d. to consist of particular parts, groups
5. stakeholder	e. enough in quantity or of a good enough quality for a particular purpose
6. requirement	f. a way of doing something, especially the correct or usual way
7. component	g. the process of putting the parts of something together
8. predetermined	h. something that must be done because of a law or rule
9. comprise	i. someone who buys goods or services from a shop, company
10. assembly	j. the practice of checking the quality of goods or services that a company sells, so that the standard continues to be good
11. procedure	
12. installation	

Unit 2. Semiconducting Devices

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. These microprocessors are much cheaper to produce than are specially designed, single-purpose microprocessors.
b. A microprocessor is made of integrated circuits, or semiconductor chips (or may consist of a single such chip).
c. Most microprocessors use standard, mass-produced chips with the specific program built in by the manufacturer as software.
d. Each chip normally consists of active devices, such as transistors, diodes, or logic circuits, combined with passive components, such as resistors and capacitors (see electronics).

Exercise 2. Fill in the gaps with the words from the box.

such as	is	thus	are	failure	and

Every effort (1) … made to integrate (2) … many electronic (3) … logic components as possible within the chip and (4) … reduce external connections. (5) … connections (6) … the parts in a microprocessor that are most prone to (7) ….

Exercise 3. Put the words and phrases of the given sentences into the proper order.
1. compact chips/ is/ in the development of/ The key process/ increasingly/ microlithography/.
2. with the help of/ the circuits/ are laid out,/ a human hair/ usually/ computers, photographically reduced/ where individual circuit lines/In this process/ are less/ than/ one thousandth/ / and then/ the width of/ to a size/.
3. referred to/ as large-scale integration (LSI),/ the popular 256-Kb (kilobit, or thousand-bit)/ which/ the production of/ Early miniaturization techniques,/ memory chip/ resulted in/ were/.
4. being a binary digit,/of 262/actually has a storage capacity/,144 bits,/ with each bit// either a 1 or a 0/ A 256-Kb chip/.
5. in/Today,/ more than/ 100 million transistors/ as a result of/ultra-large-scale integration (ULSI),/ chips/ can/ be made/ that contain/ an area/ the size of/ a postage stamp/.
6. of data/chips/ These/ as much as 512 Mb (megabits, or million bits)/ can each store/.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1.	integrated circuit	a.	a substance, such as silicon, that allows some electric currents to pass through it, and is used in electronic equipment
2.	semiconductor	b.	if two or more things integrate, or if you integrate them, they combine or work together in a way that makes something more effective
3.	chip	c.	more and more all the time
4.	program	d.	a way of thinking about something that seems correct and reasonable, or a set of sensible reasons for doing something
5.	software	e.	to spread something out
6.	integrate	f.	the sets of programs that tell a computer how to do a particular job
7.	logic	g.	the amount of space a container, room etc has to hold things or people
8.	miniaturization	h.	a small piece of silicon that has a set of complicated electrical connections on it and is used to store and process information in computers:
9.	increasingly	i.	a set of instructions given to a computer to make it perform an operation
10.	lay out	j.	a very small set of electronic connections printed on a single piece of semiconductor material instead of being made from separate parts
11.	storage		
12.	capacity		

(adopted from «electronics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2
Making a Chip

Microprocessor applications have grown rapidly since the 1970s. Most of this growth has been due to improvements in the manufacturing of chips, especially in lithography. The typical production process begins with a thin wafer of silicon, known as the substrate, that is covered with a thin metallic coating. A photosensitive polymer, called resist, is then applied as a very thin film. Placed over it is a microphotographic pattern of the circuit lines to be formed, called a mask. After exposure to ultraviolet light, the wafer is developed. The exposed resist, which is not protected by the mask, dissolves, and the wafer beneath is etched to remove the metallic film. This leaves only metal circuit lines on the

silicon substrate. The narrower these lines, the more elements that will fit in a given area and the less time required for a signal to travel from one component to the next—thus the faster the processor. A similar lithographic process is used to deposit other materials in specified layers at exact locations.

Every few years the wavelength of the ultraviolet light used in producing computer chips has been decreased. This reduction has allowed engineers to etch smaller and smaller circuit lines on the chips—and thus generally has corresponded to a jump in the number of transistors that can be packed onto each chip.

Much of the manufacturing cost of integrated circuits depends on the production volume. Chips must be mounted in a carrier, which has pins to provide electrical connections, through sockets or soldering to other components of the system. A large number of pins may complicate assembly of the printed circuit board. As a result, with the aid of robots, modern board assembly has been largely automated for more efficient production.

(adopted from «electronics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

mask	microprocessor applications	integrated circuits
engine capacity	lithography	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Microprocessor applications have grown swiftly since the 1970s.
2. This growth has been due to improvements in lithography only.
3. To start the process a thin wafer of silicon is covered with a thin metallic coating.
4. A photosensitive polymer is called resist.
5. The wafer is developed after exposure to fresh air.
6. Every few years engineers prolong the wavelength of the ultraviolet light.
7. The manufacturing cost of integrated circuits is affected by the production volume.

Exercise 4. Answer the following questions:

1. When did microprocessor applications grow?
2. What kinds of improvements facilitated this grow?
3. What does the typical production process begin with?
4. How is a photosensitive polymer applied?
5. What influences the speed of the processor?
6. What does the manufacturing cost of integrated circuits depend on?
7. What helps to automate the assembly process?

Exercise 5. Match the words or phrases with their definitions.

1. application	a. to make lines or patterns appear on something very clearly
2. light	b. a very thin flat piece of a hard substance
3. wafer	c. to plan, organize, and begin an event or a course of action:
4. board	d. the total amount of something, especially when it is large or increasing
5. etch	e. practical purpose for which a machine, idea etc can be used, or a situation when this is used
6. processor	f. the process of making or growing things to be sold, especially in large quantities
7. decrease	g. a decrease in the size, price, or amount of something, or the act of decreasing something
8. reduction	h. to become less or go down to a lower level, or to make something do this
9. correspond to	i. the central part of a computer that deals with the commands and information it is given
10. production	j. to be very similar to or the same as something else
11. volume	
12. mount	

Part 3
Transistor

A solid-state electronic device used primarily for switching and amplification, the transistor revolutionized both electronic communication and computation. Since John Bardeen, W.B. Shockley, and W.H. Brattain invented it in 1947, it has almost entirely replaced the vacuum tube in electronic devices. It is more reliable, more flexible, and smaller in size, and it consumes less electricity. Its application ranges from small radios to the most sophisticated space probes.

At one time the most widely used transistor was the bipolar junction transistor (BJT). Bipolar denotes that both positive and negative carriers that can carry an electric charge are present, while junction refers to the presence of two differently modified materials in close contact. Currently most transistors are made of a silicon base that is a semiconductor—that is, it does not allow current to flow as easily as in a good conductor, such as a copper wire; yet it does not oppose it like a good insulator. The ability to conduct may be altered greatly by doping, or adding small amounts of impurities such as arsenic or gallium.

Depending on the impurity added, the silicon may have a majority of mobile negative charge carriers (n-type) or a majority of positive charge carriers (p-type). In the usual n-p-n-type transistor, a thin slice of p-type silicon is sandwiched between two n-type slivers. The thin n-type portions are a collector and an emitter. By changing the very small current in the base of the transistor, a much larger current flowing in the collector and emitter may be controlled. As the base current is increased, the effective resistance from collector to emitter is decreased. This phenomenon gives rise to the term transistor, a combination of the words transfer and resistor.

(adopted from «electronics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

vacuum tube	semi-automatic	solid-state device	purity
semiconductor			

Exercise 2. Put them in order they appear in the text.

Exercise 3. Are the following statements true or false?

1. The transistor is a solid-state electronic device used more often for switching than for amplification.
2. The transistor was invented in 1948.
3. The transistor has more or less completely substituted the vacuum tube in electronic devices.
4. The transistor's advantages include: increased reliability, flexibility and smaller size.
5. The bipolar junction transistor is the most widely used transistor.
6. At present most transistors are made of a silicon base that is a semiconductor.
7. The term transistor originated from a combination of the words transfer and resist.

Exercise 4. Answer the following questions:

1. What are transistors primarily used for?
2. Who invented the transistor?
3. What are the transistor's advantages?
4. What kind of transistors used to be employed previously?
5. How are modern transistors made?
6. How can the current be controlled?
7. What two words does the term 'transistor' comprise?

Exercise 5. Match the words or phrases with their definitions.

1. tube	a. solid-state electrical equipment contains electronic parts, such as silicon chips, rather than moving mechanical parts
2. computation	b. a round pipe made of metal, glass, rubber etc, especially for liquids or gases to go through
3. transistor	c. the change of the way a machine operates, using a switch
4. amplification	d. a flow of electricity through a wire
5. switching	e. a substance of a low quality that is contained in or mixed with something else, making it less pure
6. solid-state	f. to be in a very small space between two other things
7. impurities	g. a chemical substance that exists as a solid or as a powder and is used to make glass, bricks, and parts for computers.
8. arsenic	h. the process of calculating or the result of calculating
9. silicon	i. a very poisonous chemical substance that is sometimes used to kill rats, insects, and weeds.
10. to sandwich	j. the increase of the effects or strength of something
11. current	
12. semiconductor	

Unit 3. Bioengineering

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. Faced with this challenge, bioengineers have refined nondestructive testing techniques that had been regarded as too specialized and expensive for industrial application.
b. In order to understand and diagnose body functions, it is necessary to use measuring devices that are very sensitive but at the same time have little or no effect upon the body.
c. Electrical potential and impedance are conditions of an electric circuit.
d. These nondestructive techniques include tests that use electrical potential and electrical impedance.

Exercise 2. Fill in the gaps with the words from the box and read the whole paragraph.

than	by	been	had	are	such	of	does	in

Transducers, devices that convert one form (1) … energy into another form, are used (2) … these systems. The electrical potentials generated (3) … living things are used to measure a variety of biological activities. Electrical potentials (4) … generated by the heart during the cardiac cycle, by skeletal muscles during contraction, and by nerve cells during voluntary and involuntary actions. The magnitude of (5) … potentials is no more (6) … a few millivolts, and the frequency range (7) … not exceed 200 hertz (cycles per second). Since the impedance of a single neuron may approach 50 to 100 megohms, amplifiers with extremely high input impedances have (8) … built for the accurate measurement of these small potentials.

Exercise 3. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1. is received/an outside stimulus,/ by the sensory system,/ information/ is usually transmitted/ When/through/ or signal,/the organism/ as an electrical potential/ its/.
2. and/ these potentials/ the type of stimulus/ identifies/ received/ gauges/ The measurement of/ of the sensory system/ the efficiency/.
3. the degree of/in impedance/ the change/ and indicate/ tissue perfusion/ Special instruments/ can detect/.
4. by/ are/ New biosensors/ developed/ being/ biomedical engineers/.
5. and/ use/ a biological sensing element,/ and/ are used/ for laboratory/ These devices/ such as/diagnostics/monitoring/ of living organisms/ enzymes or cells,/.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words or phrases with their definitions.

1. diagnose	a. relating to the heart
2. device	b. one of the pieces of flesh inside your body that you use in order to move, and that connect your bones together
3. refine	c. a measure of the power of a piece of electrical equipment to stop the flow of an alternating current
4. convert	d. great size or extent
5. in order to	e. a chemical substance that is produced in a plant or animal, and helps chemical changes to take place in the plant or animal
6. cardiac	f. to improve a method, plan, system etc by gradually making slight changes to it
7. nondestructive	g. to change something into a different form of thing, or to change something so that it can be used for a different purpose or in a different way
8. muscle	h. of, relating to, or used in diagnosis

9. magnitude — i. to find out what illness someone has, or what the cause of a fault is, after doing tests, examinations
10. impedance — j. a machine or tool that does a special job
11. enzyme
12. diagnostics

(adopted from «bioengineering.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2
Imaging

Many diseases affect the body by changing the anatomy, or structure, of some body part. The ability to «see» inside the body is very important for accurate diagnosis. Endoscopes are tubes with many fiberglass bundles that both transmit and collect light. These devices are inserted into the body through natural openings or incisions and provide pictures of tissues. Ultrasound is sound energy at frequencies above the level of normal human hearing (that is, above 20,000 hertz). Like X-rays, ultrasound can present an image of body structures. Unlike X-rays, however, well controlled ultrasound is harmless to tissue, and can be used repeatedly over a long time period. Biological measurement with ultrasound is possible because its propagation, or transmission, varies with the mechanical properties of the tissue. Because various tissues absorb and scatter ultrasonic energy differently, ultrasound is often used for the detection of boundaries between various types of tissue, such as that between skin and muscle.

Standard two-dimensional and prototype three-dimensional ultrasonic imaging can also detect changes in organs due to disease. Such changes include the buildup of atherosclerotic plaques in arteries or the development of tumors in the liver and other organs. Very high frequency ultrasound transducers are also mounted on the tips of catheters that can be inserted into specific blood vessels to obtain images of the insides of arteries. Furthermore, the constant motion of blood cells changes the frequency with which ultrasound is reflected off of them. Thus, bioengineers can determine the speed of blood flow in any part of the body by measuring the frequency of reflected ultrasonic waves and converting this into color-coded flow images.

(adopted from «bioengineering.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

bioengineering	X-ray	ultrasonic imaging	accurate diagnosis	heart

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Various diseases affect the body by changing the anatomy, or structure, of some body part.
2. The ability to «see» inside the body is very necessary for accurate diagnosis.
3. Endoscopes are metal tubes that both transmit and collect light.
4. Ultrasound is sound energy at frequencies greater than normal human hearing can perceive.
5. Only ultramodern ultrasonic imaging can detect changes in organs due to disease.
6. The constant motion of brain cells changes the frequency with which ultrasound is reflected off of them

Exercise 4. Answer the following questions:

1. How do many diseases affect the body?
2. What ability is very important for accurate diagnosis?
3. What are endoscopes used for?
4. Can we hear ultrasound?
5. What are similarities and differences of X-rays and ultrasound?
6. Why is biological measurement with ultrasound possible?
7. What changes in the body can ultrasonic imaging detect?
8. How can bioengineers determine the speed of blood flow?

Exercise 5. Match the words or phrases with their definitions.

1. affect — a. the structure of a body, or of a part of a body
2. anatomy — b. a photograph of part of someone's body, taken to see if anything is wrong
3. disease — c. he number of radio waves, sound waves etc that pass any point per second
4. accurate — d. correct and true in every detail
5. diagnosis — e. a neat cut made into something, especially during a medical operation
6. incision — f. the process of discovering exactly what is wrong with someone or something, by examining them closely
7. tissue — g. the first form that a new design of a car, machine etc has, or a model of it used to test the design before it is produced
8. frequency — h. unable or unlikely to hurt anyone or cause damage
9. X-ray — i. the material forming animal or plant cells
10. harmless — j. an illness which affects a person, animal, or plant
11. prototype
12. speed

Part 3

Treatment

Many new techniques continue to be developed for the treatment or correction of disease. For cardiovascular disease, which remains one of the leading causes of death in the United States, traditional methods involve the surgical use of a natural vein graft from the patient to bypass regions of arterial blockage, most often the coronary arteries of the heart. When adequate veins are not available, grafts made from artificial materials such as Dacron and other polymers are substituted. Ongoing studies are attempting to reduce the body's rejection of artificial grafts by coating the artificial materials with the body's own cells prior to implantation—a procedure called endothelial cell seeding.

Newer devices have been developed that provide less traumatic, simpler, and less expensive means of treatment. Balloon angioplasty procedures involve inserting a catheter, or thin tube, with a deflated balloon attached to its tip into an artery to break apart arterial obstructions. Once in place, the balloon is inflated against the obstruction until it compresses the plaque into the artery wall. This opens up the inside of the artery and increases the blood flow through the artery. Modifications to this approach include catheter-tip lasers, which ablate, or vaporize, the plaque, and atherectomy devices, which use a sharp, rotating blade to cut the plaque from the vessel wall.

Lasers can also be found in surgical procedures in which their clean and precise cutting ability is used to open tissues. In other devices, their high heat-generating capacity is used to weld tissues together. This is a preferred technique for retinal repair. Photodynamic therapy against solid cancerous tumors begins by incorporating into the body a special dye that attaches only to the tumor. An argon ion laser then activates the dye and destroys the tumor using the intense heat the laser generates.

(adopted from «bioengineering.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

grafts	cardiovascular disease	bioengineering	angioplasty procedures
surgical procedures			

Exercise 2. What do the key from Exercise 1 words refer to?

Exercise 3. Are the following statements true or false?

1. Many new techniques continue to be developed for the treatment or correction of human behaviour.
2. Heart diseases remain one of the leading causes of death in the United States.

3. Innovative methods involve the surgical use of a natural vein graft from the patient to bypass regions of arterial blockage.
4. Grafts made from artificial materials are used only when adequate veins are not available.
5. Scientists are trying to reduce the body's rejection of artificial grafts by endothelial cell seeding.
6. Newer devices have been developed only to reduce the cost of the method.
7. Lasers are used in surgical procedures because of their clean and precise cutting ability.

Exercise 4. Answer the following questions:

1. What do new techniques continue to be developed for?
2. What disease is the leading cause of death in the USA?
3. What traditional methods are used for treatment of such diseases?
4. What are two types of grafts?
5. What are the advantages of newer devices?
6. Describe balloon angioplasty procedures.
7. Why are lasers used in surgical procedures?

Exercise 5. Match the words with their definitions.

1. treatment	a. something that is done to cure someone who is injured or ill
2. cause	b. a person, event, or thing that makes something happen
3. traditional	c. a piece of healthy skin or bone taken from someone's body and put in or on another part of their body that has been damaged
4. graft	d. a thin tube that is put into your body to remove liquids
5. coronary	e. repair of blood vessel or heart valve in order to increase or restore blood flow
6. artificial	f. relating to the heart
7. implantation	g. the process of putting something into someone's body by performing a medical operation
8. correction	h. following ideas and methods that have existed for a long time, rather than doing anything new or different
9. heat-generating	i. not real or not made of natural things but made to be like something that is real or natural
10. angioplasty	j. a mass of diseased cells in your body that have divided and increased too quickly
11. catheter	
12. tumor	

Unit 4. Solid State Physics

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. Such studies have led to the discovery of new and unexpected physical properties.
b. They try to understand how the behavior of atoms and molecules within solids gives the solids their observed properties.
c. Solid state physicists study the internal structures of solids.
d. Computers, spaceships, color television sets, telephones, satellites, and hearing aids all owe many of their recent advances to the young science of solid state physics.

Exercise 2. Fill in the gaps with the words from the box and read the whole paragraph.

properties said its of are transistor on is much have announced

In (1) … modern form, solid state physics (2) … usually (3)… to have begun around the end (4) … World War II. The development of the (5) …, based (6) … theories about the electrical (7) … of semiconductor solids, was (8) … in 1948. It replaced the (9) … bulkier vacuum tube in radios, in computers, and in many scientific instruments.

Exercise 3. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1. similar to/ Semiconductor devices/ have made/ the construction of/ possible/ tiny/ electronic circuits/ transistors/.
2. with a very limited market/ fields—/found application/ in a wide range of/ from/ extremely expensive/ television sets,/ mass-produced consumer goods/computers/ to/ These/ such low-priced,/ have/ as radios,/ and telephones/.
3. based on/In/ how solid ruby absorbs/ the first/ and emits/ was developed,/ theories/ about/ 1960/ laser/.
4. linear accelerator/laser light/ has been sent to/ has been used in/the moon/ back,/ a two-mile-long/ delicate eye surgery,/ and/ and/has guided/ Since then,/the construction of/.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words and phrases with their definitions.

1. satellite	a. a firm object or substance that has a fixed shape, not a gas or liquid
2. spaceship	b. the form in which some types of energy such as light and sound travel
3. advance	c. a red jewel
4. solid	d. a change, discovery, or invention that brings progress
5. ruby	e. medical treatment in which a surgeon cuts open your body to repair or remove something inside
6. development	f. a smooth steady movement of liquid, gas, or electricity
7. absorb	g. a machine that has been sent into space and goes around the Earth, moon etc, used for radio, television, and other electronic communication
8. flow	h. a device in which a rapidly alternating electric field is set up in a resonant cavity by radio-frequency oscillators.
9. wave	i. takes smth in
10. laser	j. a beam of light produced by a laser
11. linear accelerator	
12. surgery	

(adopted from «solid state physics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2
Applications of Solid State Theory

While developing solid state theory researchers learned that metallic mixtures might have desirable properties different from those of their individual metals. But no one knew what internal changes caused these improvements, and there was no way to foresee whether a particular mixture would have the qualities sought. Man depended on accidental discoveries.

The situation is now quite different. New solid state devices are often preceded by theoretical predictions that they will have desirable properties. For example, scientists have applied solid state theory to control the magnetic properties of ferrites. Since ferrites are not electrical conductors, they are used in television tubes and as antenna cores. The magnetic orientation of ferrites is easily and quickly changed by the application of an external magnetic field. This explains their use as the «memory» storage units of computers.

Many solid state applications have developed from the theories of imperfections in solids. Alloys— mixtures of metals—may be stronger than any of their metallic components if the atoms of one of these metals fill microscopic gaps, called edge dislocations, in the crystal structure of another. But sometimes the atoms of a metal in an alloy may act as lubricants rather than cements, and the alloy may then be weaker than any of its component metals.

The functioning of transistors and solar cells depends on the addition of impurity atoms to a semiconductor. When an impurity atom adds extra electrons, a negative semiconductor area is formed. When it provides positions where electrons can settle, a positive semiconductor area is formed. A series of three alternating negative and positive areas can easily conduct an electric current.

(adopted from «solid state physics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

semiconductor	solid state devices	metallic mixtures
emergency surgery	alloys	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Metallic mixtures might have desirable properties similar to those of their individual metals.
2. It was obvious what internal changes caused these improvements.
3. The situation has changed.
4. Scientists apply solid state theory to control the properties of some metals.
5. In some cases alloys may be stronger than any of their metallic components.
6. Metallic mixtures may not then be weaker than any of its component metals.
7. A positive semiconductor area is formed when an impurity atom provides positions where electrons can settle.

Exercise 4. Answer the following questions:

1. What qualities of alloys were not clear from the beginning of solid state theory development?
2. Why did scientists depend on accidental discoveries?
3. What precedes the appearance of solid state devices nowadays?
4. What have scientists applied solid state theory for?
5. What have been developed from the theories of imperfections in solids.
6. The functioning of what kinds of devices does depend on the addition of impurity atoms to a semiconductor?
7. How are negative and positive semiconductor areas formed?

Exercise 5. Match the words or phrases with their definitions.

1. alloy	a. two or more substances that are mixed together but not chemically combined and that may vary in proportion
2. metallic	b. a mass of iron used to concentrate and strengthen the magnetic field resulting from a current in a surrounding coil
3. mixture	c. a substance such as oil that you put on surfaces that rub together, especially parts of a machine, in order to make them move smoothly and easily
4. discovery	d. a metal that consists of two or more metals mixed together
5. prediction	e. a statement about what you think is going to happen, or the act of making this statement
6. properties	f. to use something such as a method, idea, or law in a particular situation, activity, or process
7. apply	g. when something comes down and stays in one place
8. core	h. the quality or state of being imperfect
9. imperfection	i. an elementary particle that has a negative charge of electricity and travels around the nucleus of an atom
10. lubricant	j. a fact or thing that someone finds out about, when it was not known about before
11. settle	
12. electron	

Part 3
Concepts of Solid State Physics

Filled energy bands contain all the electrons that are attached to their atoms. When electrons occupy the conduction band they are completely free of their atoms and available to an electric current. Energies falling between the conduction band and a filled band are said to be in a forbidden region. Quantum calculations predict that other atoms in the crystal reflect electrons having forbidden energies, thereby preventing their movement in an electric current.

In metals, some electrons have enough energy to occupy the partially empty conduction band even at very low temperatures (they are free from their atoms). In insulators, all the bands are completely filled (electrons are attached to their atoms), and no electrons are left over to join the conduction band. Furthermore, the jump to the empty conduction band is very great—five to seven electron volts—so electrons are not likely to gain enough energy to reach it. Finally, in semiconductors, the energy bands are completely filled, with no electrons left over. But the gap between one filled band and the empty conduction band is very small—about 0.5 electron volts—so a small energy input such as the thermal energy at ordinary temperatures can boost some of the electrons into the conduction band.

A metal can carry an electric current because it always has electrons in the conduction band. Its electrical conductivity decreases as the temperature rises because the more energetic atoms interfere with electron movement. A semiconductor permits electricity to pass through it only if an external source of energy, such as an electric current or heat, is introduced. Its electrical conductivity therefore increases with temperature. Finally, an insulator—for example, a rubber sole—will not ordinarily conduct electricity. But if an enormous electric field is applied—for instance, if an object is struck by a lightning bolt—enough energy is supplied to raise some electrons over the large forbidden region into the conduction band. In such circumstances the insulator will also conduct electricity.

(adopted from «solid state physics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

X-rays	semiconductors	filled energy bands	metallic mixtures
electrical conductivity			

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Filled energy bands contain some electrons that are attached to their atoms.
2. In insulators all electrons are attached to their atoms.
3. Quantum calculations predict that some atoms in the crystal reflect electrons having forbidden energies, thus prevent their movement in an electric current.
4. In metals, some electrons have enough energy to occupy the partially empty conduction band only at very low temperatures.
5. Electrons are unlikely to gain enough energy to reach the empty conduction band.
6. The gap between one filled band and the empty conduction band is tiny.
7. An insulator never conducts electricity.

Exercise 4. Answer the following questions:

1. What kinds of electrons are contained in filled energy bands?
2. When are electrons completely free of their atoms and available to an electric current?
3. What do quantum calculations predict?
4. What are the differences between metals and insulators?
5. How great is the jump to the empty conduction band for electrons?
6. Why can a metal carry an electric current?
7. In what circumstances will the insulator also conduct electricity?

Exercise 5. Match the words or phrases with their definitions.

1. insulator	a. relating to or caused by heat
2. conduction band	b. the range of electron energy, higher than that of the valence band, sufficient to make the electrons free to accelerate under the influence of an applied electric field and thus constitute an electric current
3. gap	c. a flow of electricity through a wire
4. thermal	d. ability to conduct electricity, heat
5. ordinary	e. a space between two objects or two parts of an object, especially because something is missing
6. boost	f. a material or object which does not allow electricity, heat, or sound to pass through it
7. current	g. average, common, or usual, not different or special
8. interfere with	h. to become less or go down to a lower level, or to make something do this
9. conductivity	i. to increase in force, power, or amount
10. decrease	j. to act on one another
11. contain	
12. energies	

Unit 5. Materials Science

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a. These, taken together and related through the laws of thermodynamics, govern a material's microstructure, and thus its properties.

b. In materials science, rather than haphazardly looking for and discovering materials and exploiting their properties, one instead aims to understand materials fundamentally so that new materials with the desired properties can be created.

c. The major determinants of the structure of a material and thus of its properties are its constituent chemical elements and the way in which it has been processed into its final form.

d. The basis of all materials science involves relating the desired properties and relative performance of a material in a certain application to the structure of the atoms and phases in that material through characterization.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1. them/ people;/ is/An old adage/ «materials/ are/ like/ it/ the defects/ make/ interesting»/ in materials science says:/ that/.
2. physically impossible/a perfect crystal/ a material/ is/ The manufacture of/ of/.
3. vacancies/ materials scientists/ with the desired properties/crystalline materials/ such as/ interstitial atoms,/precipitates,/ grain boundaries,/ Instead/ manipulate the defects in/or/ substitutional atoms,/ to create materials/.

Exercise 3. Fill in the gaps with the words from the box and read the whole paragraph.

is crystal than arrangements degrees and to properties have of

Not all materials have a regular (1) … structure. Polymers display varying (2) … of crystallinity. Glasses, some ceramics, and many natural materials are amorphous, not possessing any long-range order in their atomic (3) …. These materials are much harder to engineer (4) … crystalline materials. Polymers are a mixed case, and their study commonly combines elements (5) … chemical (6) … statistical thermodynamics to give thermodynamic, rather than mechanical, descriptions of physical properties. In addition (7) … industrial interest, materials science has gradually developed into a field which provides tests for condensed matter or solid state theories. New physics emerge because of the diverse new material (8) … which need to be explained.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1.	exploit	a.	in every way that is important or basic
2.	haphazardly	b.	having no definite shape or features
3.	fundamentally	c.	made something more close, compact, concise, or dense
4.	performance	d.	to use something fully and effectively
5.	thermodynamics	e.	a chemical compound that has a simple structure of large molecules
6.	crystal	f.	the science that deals with the relationship between heat and other forms of energy
7.	defect	g.	a solid substance that has been chemically separated from a liquid
8.	precipitate	h.	a solid form of a substance or mixture that has a regularly repeating internal arrangement of its atoms and often external plane faces
9.	polymer	i.	the manner in which something performs
10.	amorphous	j.	a fault or a lack of something that means that something or someone is not perfect
11.	provide		
12.	condensed		

(adopted from «Materials science.» http://en.wikipedia.org/w/index.php?title=Materials_science&oldid=166092000)

Part 2
Materials in industry

Radical materials advances can drive the creation of new products or even new industries, but stable industries also employ materials scientists to make incremental improvements and troubleshoot issues with currently used materials. Industrial applications of materials science include materials design, cost-benefit tradeoffs in industrial production of materials, processing techniques (casting, rolling, welding, ion implantation, crystal growth, thin-film deposition, sintering, glassblowing, etc.), and analytical techniques (characterization techniques such as electron microscopy, x-ray diffraction, calorimetry, nuclear microscopy (HEFIB), Rutherford backscattering, neutron diffraction, etc.).

Besides material characterisation, the material scientist/engineer also deals with the extraction of materials and their conversion into useful forms. Often the presence, absence or variation of minute quantities of secondary elements and compounds in a bulk material will have a great impact on the final properties of the materials produced, for instance, steels are classified based on 1/10th and 1/100 weight percentages of the carbon and other alloying elements they contain. Thus, the extraction and purification techniques employed in the extraction of iron in the blast furnace will have an impact of the quality of steel that may be produced.

The study of metal alloys is a significant part of materials science. Of all the metallic alloys in use today, the alloys of iron (steel, stainless steel, cast iron, tool steel, alloy steels) make up the largest proportion both by quantity and commercial value. Iron alloyed with various proportions of carbon gives low, mid and high carbon steels. For the steels, the hardness and tensile strength of the steel is directly related to the amount of carbon present, with increasing carbon levels also leading to lower ductility and toughness. The addition of silicon and graphitization will produce cast irons (although some cast irons are made precisely with no graphitization). The addition of chromium, nickel and molybdenum to carbon steels (more than 10%) gives us stainless steels.
(adopted from «Materials science.» http://en.wikipedia.org/w/index.php?title=Materials_science&oldid=166092000)

Exercise 1. Look through the text and define which industrial applications of materials science are mentioned in it.

Exercise 2. What types of industrial applications do they refer to?

Exercise 3. Are the following statements true or false?

1. Radical materials advances can cause the creation of either new products or even new industries.
2. Industrial applications of materials science include materials design, cost-benefit tradeoffs in industrial production of materials, processing techniques, and analytical techniques.
3. Electron microscopy, x-ray diffraction, calorimetry, nuclear microscopy (HEFIB) are characterization techniques of industrial application of materials science.
4. The material scientist/engineer handles with the extraction of materials in order they do not convert into unexpected useful forms.
5. Very often minute quantities of secondary elements and compounds in a bulk material have a great impact on the final quality of the materials produced.
6. Materials science does not deal with alloys.
7. The hardness and tensile strength of the steel is directly connected with the amount of carbon present.

Exercise 4. Answer the following questions:

1. What can radical materials advances drive to?
2. Why do stable industries employ materials scientists?
3. What are industrial applications of materials science?
4. What does the material scientist/engineer deal with?
5. Why is this work so important?
6. What is a significant part of materials science?
7. What is the most often used metallic alloy?

Exercise 5. Match the words or phrases with their definitions.

1. casting	a. the major stage of a crystallization process, after the nucleation stage. It occurs from the addition of new atoms, ions, or polymer strings into the characteristic arrangement, or lattice, of a crystal
2. welding	b. a crystallographic method for the determination of the atomic structure of a material
3. ion implantation	c. the science of measuring the heat of chemical reactions or physical changes

4. crystal growth	d. a family of non-destructive analytical techniques which reveal information about the crystallographic structure, chemical composition, and physical properties of materials and thin films
5. thin-film deposition	e. the process of forming glass into useful shapes while the glass is in a molten, semi-liquid state
6. materials advances	f. a type of microscope that uses electrons as a way to illuminate and create an image of a specimen
7. materials design	g. a manufacturing process by which a liquid material such as a suspension of minerals as used in ceramics or molten metal or plastic is introduced into a mould, allowed to solidify within the mould, and then ejected or broken out to make a fabricated part
8. glassblowing	h. a fabrication process that joins materials, usually metals or thermoplastics, by causing coalescence
9. electron microscope	i. technique for depositing a thin film of material onto a substrate or onto previously deposited layers.
10. X-ray scattering techniques	j. a materials engineering process by which ions of a material can be implanted into another solid, thereby changing the physical properties of the solid
11. calorimetry	
12. neutron diffraction	

Part 3
Parts of Material Science

Significant metallic alloys are those of aluminium, titanium, copper and magnesium. Copper alloys have been known for a long time (since the Bronze Age), while the alloys of the other three metals have been relatively recently developed. Due to the chemical reactivity of these metals, the electrolytic extraction processes required were only developed relatively recently. The alloys of aluminium, titanium and magnesium are also known and valued for their high strength-to-weight ratios and, in the case of magnesium, their ability to provide electromagnetic shielding. These materials are ideal for situations where high strength-to-weight ratios are more important than bulk cost, such as in the aerospace industry and certain automotive engineering applications.

Other than metals, polymers and ceramics are also an important part of materials science. Polymers are the raw materials (the resins) used to make what we commonly call plastics. Plastics are really the final product, created after one or more polymers or additives have been added to a resin during processing, which is then shaped into a final form. Polymers which have been around, and which are in current widespread use, include polyethylene, polypropylene, polyvinyl-chloride, polystyrene, nylons, polyesters, acrylics, polyurethane, and polycarbonates. Plastics are generally classified as «commodity», «specialty» and «engineering» plastics.

PVC (polyvinyl-chloride) is a commodity plastic; it is widely used, inexpensive, and annual production quantities are huge. It lends itself to an incredible array of applications, from faux leather to electrical insulation to cabling to packaging and vessels. Its fabrication and processing are simple and well-established. The versatility of PVC is due to the wide range of additives that it accepts. The term «additives» in polymer science refers to the chemicals and compounds added to the polymer base to modify its material properties.

(adopted from «Materials science.» http://en.wikipedia.org/w/index.php?title=Materials_science&oldid=166092000)

Exercise 1. Look through the text and find all metallic alloys mentioned in it.

Exercise 2. In what contexts are these alloys mentioned?

Exercise 3. Are the following statements true or false?

1. Aluminium, titanium, copper and magnesium are the only known metallic alloys.
2. Copper alloys are the oldest alloys known.
3. The alloy of aluminium is known and valued for its high strength-to-weight ratio.
4. The alloys of aluminium, titanium and magnesium are ideal for situations where high strength-to-weight ratios are less important than bulk cost.
5. Polymers and ceramics are much less important part of materials science.
6. There are a lot of polymers which are in current widespread use.
7. PVC (polyvinyl-chloride) is a widely used because of its low cost of production.

Exercise 4. Answer the following questions:

1. What are significant metallic alloys?
2. How long have copper alloys been known?
3. Why have alloys of other metals mentioned been relatively recently developed?

4. What are the alloys of aluminium, titanium and magnesium are valued for?
5. What is the difference between plastics and polymers.
6. What polymers are in current widespread use?
7. What is PVC?

Exercise 5. Match the words with their definitions.

1. relatively	a. greatness of size or mass
2. alloy	b. a relationship between two amounts, represented by a pair of numbers showing how much bigger one amount is than the other
3. ratio	c. something that is relatively small, easy etc is fairly small, easy etc compared to other things
4. plastic	d. a hard light plastic material
5. bulk	e. the process of making or producing something
6. automotive	f. lightweight plastic resistant to chemicals and moisture and used chiefly in packaging
7. raw	g. a strong artificial material that is used to make plastics, clothes, rope
8. polyethylene	h. a soft light plastic material that prevents heat or cold from passing through it, used especially for making containers
9. polypropylene	i. substances are in a natural state and not treated or prepared for use
10. polystyrene	j. relating to cars
11. nylons	
12. fabrication	

Unit 6. Nanotechnology

Part 1

Exercise 1. Fill in the gaps with the words from the box and read the whole paragraph.

are	whose	is	to	nanometers	so	field	as	scale

Nanotechnology refers broadly (1) … a field of applied science and technology (2) … unifying theme (3) … the control of matter on the atomic and molecular (4) … scale, normally 1 to 100 (5) …, and the fabrication of devices within that size range. It is a highly multidisciplinary (6)…, drawing from fields such (7) …

applied physics, materials science, colloidal science, device physics, supramolecular chemistry, and even mechanical and electrical engineering.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

a. and/ exists/ as to/ what/ new science/ technology/ these lines of research/ may result from/ Much speculation/.
b. existing sciences/ or/can be seen as/ existing sciences/ the nanoscale,/ as a recasting of/ an extension of/ using a newer,/ Nanotechnology/more modern term/ into/.
c. used/ main/ approaches/ Two/ in/ nanotechnology/ are/.
d. principles of molecular recognition/materials and devices/ molecular components/ by/ are built from/which assemble themselves/ In the «bottom-up» approach,/ chemically/.
e. nano-objects/ without atomic-level control/ In the «top-down» approach,/ larger entities/ are constructed from/.

Exercise 3. Put the sentences into the proper order and read the whole paragraph.

1. Despite the great promise of numerous nanotechnologies such as quantum dots and nanotubes, real commercial applications have mainly used the advantages of colloidal nanoparticles in bulk form, such as suntan lotion, cosmetics, protective coatings, and stain resistant clothing.
2. Examples of nanotechnology in modern use are the manufacture of polymers based on molecular structure, and the design of computer chip layouts based on surface science.
3. Combined with refined processes such as electron beam lithography and molecular beam epitaxy, these instruments allow the deliberate manipulation of nanostructures, and led to the observation of novel phenomena.
4. The impetus for nanotechnology comes from a renewed interest in colloidal science, coupled with a new generation of analytical tools such as the atomic force microscope (AFM), and the scanning tunneling microscope (STM).

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. nanotechnology	a. the term refers to the specific interaction between two or more molecules through noncovalent bonding such as including hydrogen bonding, metal coordination, hydrophobic forces, van der Waals forces, pi-pi interactions, and/or electrostatic effects
2. applied science	b. electronic components that exploit the electronic properties of semiconductor materials, principally silicon, germanium, and gallium arsenide
3. semiconductor devices	c. a powerful technique for viewing surfaces at the atomic level
4. mechanical Engineering	d. one of several methods of depositing single crystals
5. molecular recognition	e. the term refers to the area of chemistry that focuses on the noncovalent bonding interactions of molecules
6. atomic force microscope	f. the application of knowledge from one or more natural scientific fields to solving practical problems
7. scanning tunneling microscopy	g. a one-atom thick sheet of graphite (called graphene) rolled up into a seamless cylinder with diameter on the order of a nanometer.
8. molecular beam epitaxy	h. something made from a semiconductor nanostructure that confines the motion of conduction band electrons, valence band holes, or excitons (bound pairs of conduction band electrons and valence band holes) in all three spatial directions
9. quantum dot	i. a very high-resolution type of scanning probe microscope, with demonstrated resolution of fractions of a nanometer, more than 1000 times better than the optical diffraction limit
10. Supramolecular chemistry	j. an engineering discipline that involves the application of principles of physics for analysis, design, manufacturing, and maintenance of mechanical systems
11. colloidal science	
12. nanotube	

(adopted from «Nanotechnology.» http://en.wikipedia.org/w/index.php?title=Nanotechnology&oldid=166301614)

Part 2
Origin of Nanotechnology

The first use of the distinguishing concepts in 'nanotechnology' was in «There's Plenty of Room at the Bottom,» a talk given by physicist Richard Feynman at an American Physical Society meeting at Caltech on December 29, 1959. Feynman described a process by which the ability to manipulate individual atoms and molecules might be developed, using one set of precise tools to build and operate another proportionally smaller set, so on down to the needed scale. In the course of this, he noted, scaling issues would arise from the changing magnitude of various physical phenomena: gravity would become less important, surface tension and Van der Waals attraction would become more important, etc.

This basic idea appears feasible, and exponential assembly enhances it with parallelism to produce a useful quantity of end products. The term «nanotechnology» was defined by Tokyo Science University Professor Norio Taniguchi in a 1974 paper (N. Taniguchi, «On the Basic Concept of 'Nano-Technology') as follows: «'Nano-technology' mainly consists of the processing of, separation, consolidation, and deformation of materials by one atom or by one molecule.»

In the 1980s the basic idea of this definition was explored in much more depth by Dr. K. Eric Drexler, who promoted the technological significance of nano-scale phenomena and devices through speeches and the books Engines of Creation: The Coming Era of Nanotechnology (1986) and Nanosystems: Molecular Machinery, Manufacturing, and Computation, (1998), and so the term acquired its current sense. Nanotechnology and nanoscience got started in the early 1980s with two major developments; the birth of cluster science and the invention of the scanning tunneling microscope (STM). This development led to the discovery of fullerenes in 1986 and carbon nanotubes a few years later. In another development, the synthesis and properties of semiconductor nanocrystals was studied. This led to a fast increasing number of metal oxide nanoparticles of quantum dots. The atomic force microscope was invented five years after the STM was invented. The AFM uses atomic force to see the atoms.

(adopted from «Nanotechnology.» http://en.wikipedia.org/w/index.php?title=Nanotechnology&oldid=166301614)

Exercise 1. Look through the text and copy out all proper names and numerals mentioned in it.

Exercise 2. What do the proper names and numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The first use of the distinguishing concepts in 'nanotechnology' was in USA.
2. Richard Feynman is a famous chemist.

3. This basic idea appears realistic.
4. The term «nanotechnology» was defined by Beijing Science University Professor Norio Taniguchi in a 1974 paper.
5. Dr. K. Eric Drexler explored the basic idea of this definition.
6. Nanotechnology and nanoscience got started in the early 1980s with two major advances.
7. Fullerenes was rediscovered in 1986.

Exercise 4. Answer the following questions:

Where was the concept 'nanotechnology' first used?
What did Richard Feynman do?
Who defined the term «nanotechnology»?
What did Dr. K. Eric Drexler do?
When did the term acquire its current sense?
What developments got Nanotechnology and nanoscience started?
What are the differences between STM and AFM?

Exercise 5. Match the words or phrases with their definitions.

1. concept	a. information, details etc are exact, clear, and correct
2. manipulate	b. to work skilfully with information, systems etc to achieve the result that you want
3. precise	c. an idea of how something is, or how something should be done
4. phenomenon	d. to describe something correctly and thoroughly, and to say what standards, limits, qualities etc it has that make it different from other things
5. define	e. a change in the usual shape of something, especially one that makes it worse, or the process of changing something's shape
6. deformation	f. a crystalline material with dimensions measured in nanometers; a nanoparticle with a structure that is mostly crystalline.
7. Van der Waals force	g. a family of carbon allotropes named after Richard Buckminster Fuller and are sometimes called buckyballs
8. cluster	h. a synonym for the totality of non-covalent forces which act between stable molecules, are weak compared to those appearing in chemical bonding
9. fullerenes	i. small, multiatom particles

10. nanocrystal — j. something that happens or exists in society, science, or nature, especially something that is studied because it is difficult to understand

11. carbon nanotubes

12. nanoparticle

Part 3

Molecular nanotechnology

Molecular nanotechnology (MNT) is the concept of engineering functional mechanical systems at the molecular scale. An equivalent definition would be «machines at the molecular scale designed and built atom-by-atom». This is distinct from nanoscale materials. Based on Richard Feynman's vision of miniature factories using nanomachines to build complex products (including additional nanomachines), this advanced form of nanotechnology (or molecular manufacturing) would make use of positionally-controlled mechanosynthesis guided by molecular machine systems. MNT would involve combining physical principles demonstrated by chemistry, other nanotechnologies, and the molecular machinery of life with the systems engineering principles found in modern macroscale factories. Its most well-known exposition is in the books of K. Eric Drexler particularly Engines of Creation.

While conventional chemistry uses inexact processes driven toward some balance to obtain inexact results, and biology exploits inexact processes to obtain definitive results, molecular nanotechnology would employ original definitive processes to obtain definitive results. The desire in molecular nanotechnology would be to balance molecular reactions in positionally-controlled locations and orientations to obtain desired chemical reactions, and then to build systems by further assembling the products of these reactions.

(adopted from «molecular nanotechnology.» http://en.wikipedia.org/w/index.php?title=Molecular_nanotechnology&oldid=165893517)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

advanced form of nanotechnology	molecular nanotechnology
to balance molecular reactions	scanning tunneling microscope
technological significance	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. MNT is the concept of engineering functional mechanical systems at the molecular scale.
2. «Machines at the molecular scale designed and built atom-by-atom» is a definition for MNT.

3. MNT is an insignificant form of Molecular nanotechnology.
4. Richard Feynman's vision is used as basis.
5. MNT combines physical principles demonstrated by chemistry, other nanotechnologies, and the molecular machinery of life with the systems engineering principles found in modern macroscale factories.
6. Books by K. Eric Drexler are not devoted to the problems of molecular nanotechnology.
7. There are significant differences between methods used in conventional chemistry, biology and molecular nanotechnology.

Exercise 4. Answer the following questions:

1. What is molecular nanotechnology?
2. Are their any other definitions of molecular nanotechnology?
3. Give an equivalent definition.
4. What does molecular nanotechnology make use of?
5. Who wrote the most well-known book devoted to molecular nanotechnology?
6. What is the aim of conventional chemistry?
7. What is the aim of molecular nanotechnology?

Exercise 5. Match the words or phrases with their definitions.

1. concept	a. clearly different or belonging to a different type
2. system	b. the study of the design and production of machines and tools
3. mechanical engineering	c. the basic idea that a plan or system is based on
4. distinct from	d. to get something that you want, especially through your own effort, skill, or work
5. nanoscale	e. a clear and detailed explanation
6. principle	f. not exactly correct or true
7. exposition	g. a chemical change that happens when two or more substances are mixed together
8. molecular scale	h. an idea of how something is, or how something should be done
9. inexact	i. having dimensions usually measured in nanometers
10. obtain	j. is considered to be the best and cannot be improved
11. definitive	
12. reaction	

Unit 7. Biomedical engineering

Part 1

Exercise 1. Fill in the gaps with the words from the box and read the whole paragraph.

is	of	to	combines	skills	to	care

Biomedical engineering (1) … the application (2) … engineering principles and techniques (3)… the medical field. It (4) … the design and problem solving (5) … of engineering with the medical and biological science (6) … help improve patient health (7) … and the quality of life of healthy individuals.

Exercise 2. Put the sentences into the proper order and read the whole paragraph.

a. Biomedical instrumentation amplifier schematic used in monitoring low voltage biological signals, an example of a biomedical engineering application of electronic engineering to electrophysiology.
b. Examples of concrete applications of biomedical engineering are the development and manufacture of biocompatible prostheses, medical devices, diagnostic devices and imaging equipment such as Magnetic resonance imaging (MRI) and electroencephalograms (EEG), and pharmaceutical drugs.
c. As a relatively new discipline, much of the work in biomedical engineering consists of research and development, covering an array of fields: bioinformatics, medical imaging, image processing, physiological signal processing, biomechanics, biomaterials and bioengineering, systems analysis, 3-D modeling.

Exercise 3. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1. is widely considered/ a broad spectrum of/ an interdisciplinary field,/ draw influence from/ resulting in/ disciplines/ that/ Biomedical engineering/ various fields/ and/ sources/.
2. atypical for/ the extreme diversity,/ Due to/ it/ is not/ a biomedical engineer/ a particular aspect/ to focus on/.
3. are/There/ many/ taxonomic breakdowns/ one such listing defines/ different/ the aspects of/ the field/ of BME,/ as such:/ bioelectrical and neural engineering; biomedical imaging and biomedical optics; biomaterials; biomechanics and biotransport; biomedical devices and instrumentation; molecular, cellular and tissue engineering; systems and integrative engineering/.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. neural engineering	a. the use of a combination of cells, engineering and materials methods, and suitable biochemical and physio-chemical factors to improve or replace biological functions
2. biomechanics	b. means of manufacturing molecules
3. tissue engineering	c. a group of people or things, especially one that is large or impressive
4. molecular engineering	d. in a good physical condition and not likely to become ill or weak
5. healthy	e. the research and analysis of the mechanics of living organisms or the application and derivation of engineering principles to and from biological systems
6. discipline	f. an area of knowledge or teaching, especially one such as history, chemistry, mathematics etc that is studied at a university
7. array	g. a range of different people, things, or ideas
8. concrete	h. definite and specific
9. pharmaceutical	i. relating to the production of drugs and medicines
10. diversity	j. an emerging interdisciplinary field of research that uses engineering techniques to investigate the function and manipulate the behavior of the central or peripheral nervous systems
11. engineering principle	
12. skills	

(adopted from «Biomedical engineering.» http://en.wikipedia.org/w/index.php?title=Biomedical_engineering&oldid=167207918)

Part 2

Clinical engineering

Clinical engineering is a branch of biomedical engineering for professionals responsible for the management of medical equipment in a hospital. The tasks of a clinical engineer are typically the acquisition and management of medical device inventory, supervising biomedical engineering technicians (BMETs), ensuring that safety and regulatory issues are taken into consideration and serving as a technological consultant for any issues in a hospital where medical devices are concerned. Clinical engineers work closely with the IT department and medical physicists.

A typical biomedical engineering department does the corrective and preventive maintenance on the medical devices used by the hospital, except for those covered by a warranty or maintenance agreement with an external company. All newly acquired equipment is also fully tested. That is, every line of software is executed, or every possible setting is Exercised and verified. Most devices are intentionally simplified in some way to make the testing process less expensive, yet accurate. Many biomedical devices need to be sterilized. This creates a unique set of problems, since most sterilization techniques can cause damage to machinery and materials. Most medical devices are either inherently safe, or have added devices and systems so that they can sense their failure and shut down into an unusable, thus very safe state. A typical, basic requirement is that no single failure should cause the therapy to become unsafe at any point during its life-cycle. See safety engineering for a discussion of the procedures used to design safe systems.

(adopted from «Biomedical engineering.» http://en.wikipedia.org/w/index.php?title=Biomedical_engineering&oldid=167207918)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

biomedical devices	sterilization technique	taxonomic breakdowns
safe	clinical engineering	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?
1. Clinical engineering is a branch of biomedical engineering.
2. Clinical engineers' work is often connected with the acquisition and management of medical device inventory.
3. They are not responsible for safety procedures.
4. Clinical engineers cooperate with a technological consultant.
5. Clinical engineers cooperate with the IT department.
6. Biomedical engineering department is in charge of maintenance on the medical devices covered by a warranty or maintenance agreement with an external company.
7. Biomedical engineering department tests all newly acquired equipment.

Exercise 4. Answer the following questions:
1. What is clinical engineering?
2. What is the task of clinical engineer?
3. Who do clinical engineers work closely with?
4. What does a typical biomedical engineering department do?
5. What do many biomedical devices require?
6. Are most medical devices safe?
7. What are the requirements for safety of medical devices?

Exercise 5. Match the words or phrases with their definitions.

1. biomedical equipment technician	a. the recognition of a disease or condition by its outward signs and symptoms
2. responsible for	b. the process by which you gain knowledge or learn a skill
3. sinus rhythm	c. the repairs, painting etc that are necessary to keep something in good condition
4. safety	d. the elimination of microbiological organisms
5. diagnosis	e. a scientist who has special knowledge and training in physics
6. electrophysiology	f. the study of the electrical properties of biological cells and tissues
7. regulatory	g. a machine or tool that does a special job
8. acquisition	h. a vital component of the healthcare delivery system. Employed primarily by hospitals
9. physicist	i. the official power to control an activity and to make sure that it is done in a satisfactory way
10. maintenance	j. term used in medicine to describe the normal beating of the heart
11. sterilization	
12. device	

Part 3
Electroencephalography

Electroencephalography is the neurophysiologic measurement of the electrical activity of the brain by recording from electrodes placed on the scalp or, in special cases, subdurally or in the cerebral cortex. The resulting traces are known as an electroencephalogram (EEG) and represent a summation of post-synaptic potentials from a large number of neurons. These are sometimes called brainwaves, though this use is discouraged, because the brain does not broadcast electrical waves. The EEG is a brain function test, but in clinical use it is a «gross correlate of brain activity». Electrical currents are not measured, but rather voltage differences between different parts of the brain.

There are a number of benefits to using EEG in neuroscience research. One is that EEG is non-invasive to the research subject. Furthermore, the need for the subject to hold still is perhaps less stringent than in functional magnetic resonance imaging (FMRI). Another benefit is that many applications of the EEG record spontaneous brain activity, and the subject does not need to be able to cooperate with the research (e.g., as is necessary in the behavioral testing of neuropsychology). Also, the EEG has a high temporal resolution compared to techniques such as FMRI and is capable of detecting changes in electrical activity in the brain on a millisecond time scale.

Much of the cognitive research conducted with EEG uses the event-related potential (ERP) technique. Most ERP experimental paradigms involve a subject being provided a stimulus to which react either overtly or covertly. There are often at least two conditions that vary in some manner of interest to the researcher. As this stimulus-response is going on, an EEG is being recorded from the subject. The ERP is obtained by averaging the EEG signal from each of the trials within a certain condition; averages from one stimulus-response condition can then be compared with averages from the other stimulus-response condition(s).

(adopted from «Electroencephalography.» http://en.wikipedia.org/w/index.php?title=Electroencephalography&oldid=166090523)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

benefits to using EEG	sinus rhythm	event-related potential technique
electroencephalography	physics	

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Electroencephalography is connected with measurement of the electrical activity of the brain.
2. Electrodes are placed only on the scalp.
3. There are few benefits to using EEG in neuroscience research.
4. EEG has a higher temporal resolution than FMRI.
5. Only FMRI is capable of detecting changes in electrical activity in the brain on a millisecond time scale.
6. Biggest part of the cognitive research conducted with EEG uses the event-related potential.
7. There are often twenty conditions that vary in some manner of interest to the researcher.

Exercise 4. Answer the following questions:

1. What is electroencephalography?
2. How is measurement in electroencephalography conducted?
3. What is an electroencephalogram?

4. What are the benefits of using EEG in neuroscience research?
5. What does cognitive research conducted with EEG use?
6. How is the ERP obtained?
7. What are averages from one stimulus-response condition compared to?

Exercise 5. Match the words or phrases with their definitions.

1. electrodes	a. a small piece of metal or a wire that is used to send electricity through a system or through a person's body
2. scalp	b. related to the process of knowing, understanding, and learning something
3. cortex	c. medical treatment that does not involves cutting into someone's body
4. clinical engineering	d. the skin on the top of your head
5. neuron	e. the scientific study of the brain
6. neuroscience	f. a type of cell that makes up the nervous system and sends messages to other parts of the body or the brain
7. non-invasive	g. to notice or discover something, especially something that is not easy to see, hear
8. stringent	h. is very strict and must be obeyed
9. resonance	i. sound that is produced or increased in one object by sound waves from another object
10. detect	j. the outer layer of an organ in your body, especially your brain
11. cognitive	
12. responsible for	

7. READING ROOM FOR STUDENTS OF NONLINEAR PROCESSES

Unit 1. Electronic Devices

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) The second important elements are conductors, which connect different circuits or different circuit elements together.
b) They are capable of performing many different functions when linked together with other elements into electronic circuits.
c) The third are capacitors, which store electrical charges.
d) Transistors and other semiconductor devices come in a wide variety of types.
e) The most important of these other elements are resistors, which impede the flow of electrons and regulate voltages and currents.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1. such circuits / The functions / perform / that / of two broad types / are generally.
2. which transform or process / carried by / information / electronic signals / The first type / logic circuits / is.
3. is / which / The second type / store the information / memory circuits.
4. are built up out of / that perform / called a bit / on each / elementary manipulations / piece of information / identical components / Logic circuits.
5. either / A bit / a 1 or a 0 / consists of.
6. known as a bite / Sometimes / another / is also used / unit of information / or eight bits.

Exercise 3. Fill in the gaps with the words from the box and read the whole paragraph.

computer	circuits	current	impulse	memory
particular	pulse	resistor	way	

The fastest 1__________ circuits are built up from arrays of transistors, as are logic 2_________. In memory circuits a transient impulse—the information to be stored—is directed to a 3__________unit, or address, in the array. This 4 _________changes the electrical state of a simple circuit in such a way that the change is stable once the impulse has passed. One simple 5 ________of making such a flip-flop circuit is to have the output of a given transistor feed back to its base through an OR gate. The other input to the OR gate is the external pulse. A single external 6_________will turn on the transistor output 7_________, which will feed back through the gate to maintain itself. An additional external pulse will turn the input off, thus flipping the circuit back.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. variety	a. not the same
2. different	b. an electronic component that transmits current in direct proportion to the voltage across it
3. linked	c. the smallest unit of storage in a digital computer, consisting of a binary digit.
4. electronic circuit	d. to adjust (a mechanism) for accurate and proper functioning
5. connect	e. connected, either with links, or as if with links
6. resistor	f. to change greatly the appearance or form of
7. capacitor	g. write (something) into memory or register
8. transform	h. a sequence of adjacent bits, almost always eight, operated on as a unit by a computer
9. store	i. to join two or more pieces.
10. bit	j. an electronic component capable of storing an electric charge; especially one consisting of two conductors separated by a dielectric
11. regulate	
12. byte	

(adopted from «Electronic Circuits» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2

Electronic devices that manipulate digital and analog signals today are predominantly semiconductors. A semiconductor is a material that conducts electricity, but only under certain conditions, in contrast with conductors that always conduct well and insulators that always conduct poorly. Semiconductors are generally made of silicon or silicon compounds that are «doped» with certain impurities to alter their electrical properties.

The basic semiconductor device is the transistor, invented in 1947 by U.S. scientists William B. Shockley, Walter H. Brattain, and John Bardeen. The typical transistor consists of three semiconductor materials bonded together. In the so-called n-p-n type, the first part, called the emitter, is doped to give it an excess of negative charges; the second, the base, is doped to give it excess positive charges; and the third, the collector, is doped to give it an excess of negative charges.

The voltage applied between the emitter and collector is fixed and relatively high, while the voltage between the emitter and the base is low and variable—it is the incoming signal. When there is no base voltage, the resistance from the emitter to the collector is high, and no current flows. A small voltage across the base to the emitter, however, lowers the resistance and allows a large output current to flow from emitter to collector. The transistor thus acts as a signal amplifier.

(adopted from «Semiconducting Devices» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

device	semiconductor	electron	transistor	velocity

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Electronic devices that manipulate digital and analog signals are conductors.
2. A semiconductor is a material that conducts electricity but under certain conditions.
3. The basic semiconductor device is the transistor.
4. Semiconductors are generally made of copper.
5. The transistor was invented in 1947.
6. The typical transistor consists of two semiconductor materials.
7. The voltage between the emitter and collector is relatively high.

Exercise 4. Answer the following questions:

1. What is a semiconductor?
2. When does a semiconductor conduct electricity?

3. What material are semiconductors made of?
4. When was the basic semiconductor invented?
5. Who invented the basic semiconductor?
6. What are the components of the typical transistor?
7. How does the transistor act?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words or phrases with their definitions.

1. device	a. an electrical or electromagnetic action, normally a voltage that is a function of time that conveys the information of the radio or TV program or of communication with another party
2. digital	b. a solid-state semiconductor device, with three terminals, which can be used for amplification, switching, voltage stabilization, signal modulation, and many other functions
3. condition	c. property of representing values as discrete numbers rather than a continuous spectrum
4. signal	d. an item intended to carry, or help carry, but not utilize electrical energy
5. transistor	e. the state of any object, referring to the amount of its wear
6. voltage	f. the amplified terminal on a bipolar junction transistor
7. charge	g. the movement of electrons
8. collector	h. to design a new process or mechanism
9. variable	i. the amount of electrostatic potential between two points in space
10. current	j. the quantity of unbalanced positive or negative ions in or on an object
11. amplifier	
12. invent	

Part 3

Modern electronic circuits are not made up of individual, separated components as was once the case. Instead, millions of tiny circuits are embedded in a single complex piece of silicon and other materials called an integrated circuit (IC).

The manufacture of integrated circuits begins with a simple circular wafer of silicon several inches across. Designers produce drawings of exactly where each element in each part of the circuit is to go. A photograph of each diagram is then reduced in size many times to produce a tiny photolithographic mask.

The silicon wafer is coated with a material called a photoresist that undergoes a chemical change when exposed to ultraviolet light. Ultraviolet light shone through the mask onto the photoresist creates the same pattern on the wafer as that on the mask. Solvents then etch away the parts of the resist that were exposed, leaving the other parts intact. Another layer of material—for example, silicon doped with some impurities—is laid down on top of the wafer, and another pattern is etched in by the same technique.

The result of hundreds of such operations is a multilayered circuit, with many millions of tiny transistors, resistors, and conductors created in the wafer. The wafer is then broken apart along prestressed lines into hundreds of identical square or rectangular chips—the finished integrated circuits.

By the early 21st century, integrated circuits made with the most advanced technology could carry hundreds of millions of individual transistors, each only 50 nanometers or smaller on a side. Many electrical engineers and scientists believe that the ultimate limits of size in these circuits might soon be reached. But the overall size of electronic components may still continue to decrease as wafer-scale integration, in which various components are produced edge-to-edge on a single wafer, is perfected and the need for circuit boards reduced.

(adopted from «Integrated Circuits» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

circuit	light	wafer	ion	silicon

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Modern electronic circuits are made up of separated components.
2. An integrated circuit is made up of tiny circuits.
3. Designers produce drawings of each element.
4. The silicon waver is coated only with photoresist.
5. An integrated circuit is covered with only one layer.
6. A multilayered circuit includes transistors, resistors and conductors.
7. Integrated circuits can carry hundreds of millions of individual transistors.

Exercise 4. Answer the following questions:

1. What are modern electronic circuits made of?
2. What is an integrated circuit?
3. What do designers do with a photograph of each diagram?
4. What material is the silicon wafer covered with?
5. Who believe that the ultimate limits of size in these circuits might soon be reached?

6. When does a photoresist undergo a chemical change?
7. What is laid down on the top of the wafer?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. component	a. in the shape of a circle
2. integrated circuit	b. a 2D symbolic representation of information according to some visualization technique.
3. circular	c. electromagnetic radiation with a wavelength shorter than that of visible light, but longer than soft X-rays.
4. inch	d. having four equal sides and four right angles
5. diagram	e. the constituents of electronic circuits
6. undergo	f. the name of a unit of length
7. ultraviolet light	g. having one or more right angles
8. square	h. a miniaturized electronic circuit (consisting mainly of semiconductor devices, as well as passive components) that has been manufactured in the surface of a thin substrate of semiconductor material.
9. rectangular	i. to grow or cause to grow gradually less or smaller, as in number, amount, or intensity
10. advanced	j. highly developed or complex
11. decrease	
12. reduce	

Unit 2. Radio Waves, Frequency and Modulation

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) Thus a carrier wave actually contains billions of single waves.
b) The sounds a person hears are vibrations or waves in the air.
c) The frequencies used for broadcasting (hundreds of kilocycles or megacycles) are called radio frequencies.
d) They cannot be seen, heard, or felt.
e) A train of waves used for broadcasting at a particular frequency is called a carrier wave.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1) frequency / can / is / about 15 / The lowest / that / be heard.
2) on a piano / Middle A / the frequency 440 / has
3) that / than 10,000 / The highest tones / considerably less / have / frequencies / can be heard.
4) give quality to / The high overtones / that / range up to / musical tones / about 15,000.
5) sound / vibration rates / audio frequencies / are called / These.

Exercise 3. Fill in the gaps with the words from the box and read the whole paragraph.

amplitude	broadcast	carrier	current	method
microphone	receiver	sound	transmission	

Audio frequencies are much too low to create satisfactory 1_________ waves for broadcasting. To 2_____________ speech or music the sound vibrations must be «loaded» onto a carrier wave for 3 _____________ across space to the 4______________. This can be done by first converting the 5_____________vibrations into vibrations in an electric current, as in a telephone. For radio the conversion is made in a 6_____________. This varying current is then used to shape, or modulate, the carrier wave. The modulating method most commonly used for broadcasting varies the strength, or amplitude, of each single wave in the carrier. This is called 7______________modulation (AM).

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. broadcasting	a. sound recording and reproduction
2. carrier wave	b. the maximum absolute value of a periodically varying quantity
3. contain	c. an electronic device that converts a radio signal from a transmitter into useful information
4. vibration	d. a sound of distinct pitch, quality, and duration; a note.
5. audio	e. the distribution of audio and/or video signals which transmit programs to an audience
6. tone	f. a waveform (usually sinusoidal) that is modulated (modified) with an input signal for the purpose of conveying information, for example voice or data, to be transmitted
7. satisfactory	g. the sending of a signal, picture, or other information from a transmitter
8. transmission	h. an instrument that converts sound waves into an electric current, usually fed into an amplifier, a recorder, or a broadcast transmitter.
9. receiver	i. giving satisfaction sufficient to meet a demand or requirement; adequate
10. conversion	j. mechanical oscillations about an equilibrium point
11. microphone	
12. amplitude	

(adopted from «Carrier Waves and Modulation» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2

In empty space, or a vacuum, radio waves spread at the same speed as light. The speed through air is almost the same. A transmitted wave will travel 186,000 miles (300,000 kilometers) during the span of one second.

To create radio waves a transmitter must send pulses at an extremely fast rate—from many thousands to millions of cycles a second. (A single wave is called a cycle. Frequencies are stated in cycles a second, or hertz. Thus, a frequency of one kilocycle a second, or one kilohertz, is 1,000 waves a second. One megacycle a second, or one megahertz, is one million waves a second.) The frequency of the wave does not alter the speed of travel.

There is a very important relationship between frequency and wavelength. Suppose a transmitter broadcasts at a frequency of 750,000 waves (750 kilocycles) a second. At the end of a second the wave sent at the start will be 186,000 miles away; and the transmitter will have sent a total of 750,000 waves. Therefore, the length of each wave is 186,000 miles divided by 750,000, or about one quarter mile. If another transmitter sends at a frequency of 1,100,000 waves (1.1 megacycles) a second, each wave will be about one sixth of a mile long.

Waves of different lengths can cross or even travel along the same lines without mixing. (Water waves of different lengths also remain separate as they cross each other.) Thus, many stations can operate in the same region without interference if their frequencies are different. The government insures that they will be by giving exclusive use of a separate, specific frequency to each station in a region. Listeners receive the station they want by tuning their receivers to the station's frequency.

(adopted from «Wavelength and Frequency» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

frequency wavelength resistor signal transmitter

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. In a vacuum radio waves spread at the same speed as light.
2. The speed through air is higher.
3. A transmitter must send pulses at an extremely fast rate to create radio waves.
4. Frequencies are stated in cycles an hour.
5. Frequency and wavelength are independent.
6. Waves of different lengths can travel without mixing.
7. Listeners receive the station they want by tuning their receivers.

Exercise 4. Answer the following questions:

1. What is the speed of radio waves in empty space or vacuum?
2. How to create a radio wave?
3. How is a single wave called?
4. What is one megacycle?
5. What is the role of a transmitter?
6. Why can many stations operate in the same region without interference?
7. How do the listeners receive a certain station?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. vacuum	a.	the measurement of the number of occurrences of a repeated event per unit of time.
2. spread	b.	a unit of phase angle equivalent to one oscillation
3. wave	c.	the SI unit of frequency
4. rate	d.	an electronic device which with the aid of an antenna propagates an electromagnetic signal such as radio, television, or other telecommunications.
5. cycle	e.	the addition (superposition) of two or more waves that results in a new wave pattern.
6. frequency	f.	the act of tuning an instrument or voice
7. hertz	g.	a quantity measured with respect to another measured quantity
8. transmitter	h.	a volume of space that is essentially empty of matter, such that its gaseous pressure is much less than standard atmospheric pressure
9. cross	i.	to distribute over a surface in a layer
10. interference	j.	a mode of energy transfer from one place to another, often with little or no permanent displacement of the particles of the medium
11. receive		
12. tuning		

Part 3

The modulation must impress upon each other, or blend, two characteristics of each distinct sound. One is its intensity, or loudness. The other is its frequency of vibration, or pitch. The pitch is the position of a musical note on the scale (or the difference between a man's lower-toned voice and a woman's higher-pitched voice). Loudness is transmitted by the amount of increase given to the amplitude of each single wave in the carrier.

As an example of how pitch is transmitted, suppose the frequency of a carrier wave is 500 kilocycles (500,000 single waves) a second. Suppose next that a low tone has a vibration rate of 100 a second. When this tone is loaded onto a carrier, each vibration in it occupies 5,000 single carrier waves. Each sound vibration, however, increases in strength during about half the time it lasts and decreases during the other half. The single carrier waves, therefore, increase gradually in amplitude for 2,500 waves then decrease gradually for the next 2,500. A vibration rate of 500 a second is loaded similarly upon 1,000 waves in the carrier (500 increasing amplitude, 500 decreasing). These durations transmit the pitch for each tone when the tone is sorted out in a receiver.

This method works no matter how many individual sounds must be carried at the same instant. There are thousands of separate sounds (tones and overtones) from the instruments of a symphony orchestra every instant that it plays. The modulating apparatus adds them electrically, however, as fast as they are received and impresses the result upon the waves in the carrier. The carrier transmits the whole sound of the orchestra. These are the same combinations of sounds that strike a listener's ears instant after instant at a concert. The brain sorts out the individual voices of the instruments whether one listens to the orchestra at the concert or through a radio receiver.

(adopted from «How Amplitude Modulation Carries Sound» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

antenna pitch vibration tone proton

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The modulation must blend five charateristics of each distinct sound.

2. The pitch is the position of a musical note on the scale.
3. Pitch is transmitted by the amount of increase given to the amplitude of each single wave in the carrier.
4. There are thousands of separate sounds from the instruments.
5. The carrier receives the whole sound of the orchestra.
6. The modulating apparatus adds them electrically, however, as fast as they are received.
7. The brain sorts out the individual voices of the instruments.

Exercise 4. Answer the following questions:

1. What are the two characteristics of the sound?
2. What is the pitch?
3. How is loudness transmitted?
4. How many carrier waves does each vibration occupy?
5. What happens to single carrier waves?
6. What is the role of the modulating apparatus?
7. What does the brain do?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. modulation	a. the property of sound that varies with variation in the frequency of vibration
2. distinct	b. advancing or progressing by regular or continuous degrees
3. intensity	c. the act of combining or the state of being combined.
4. pitch	d. the variation of a property of an electromagnetic wave or signal, such as its amplitude, frequency, or phase
5. scale	e. continuance or persistence in time
6. gradually	f. readily distinguishable from all others; discrete
7. duration	g. an almost imperceptible space of time
8. instant	h. an appliance or device for a particular purpose
9. apparatus	i. the amount or degree of strength of electricity, light, heat, or sound per unit area or volume
10. sort out	j. the sound produced by the vocal organs of a vertebrate, especially a human
11. combination	
12. voice	

Unit 3. Classes of Radio Service by Frequency

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) The Earth absorbs the wave near the transmitting station.
b) The ionosphere will not reflect the sky wave.
c) At about 30 megacycles these processes become less efficient.
d) Medium and high frequencies are used to broadcast sound.
e) The waves are transmitted by both the ground wave and the reflected sky wave.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1) must be used / Very high / for / frequencies / television.
2) can only / Therefore / telecasts / as far as / be received / can travel / waves / from the transmitter / in a straight line.
3) between the stations / When / are blocked / the waves / the curve of the Earth / rises.
4) line / This / of sight perception / is called.
5) coaxial cable / can be extended / Reception / with / relay stations / or.
6) Relays / receive the telecast / and retransmit it / about 30 miles apart / to the next relay.
7) along a chain of relays / can be broadcast / by a local station / the signals / At any point over a territory.

Exercise 3. Fill in the gaps with the words from the box and read the whole paragraph.

cable currents dimensions drag frequencies metal overcome range solid

A coaxial 1__________contains conductors of a special type. Each one is a long skin of 2___________ around a thin central wire. This construction is adopted because high-frequency 3___________ travel only on the surface of a conductor. They cannot 4___________ the forces that oppose them in a 5___________ interior. This resistance causes a drag. The coaxial design eliminates this 6___________. Construction is costly, because the 7___________ must be extremely accurate for the range of the frequencies to be carried.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. ground wave a. something that bends or turns without angles

2. sky wave — b. an electromagnetic device in which the opening or closing of one circuit operates another device
3. absorb — c. a disturbance in the air similar to a wave in water that transfers energy progressively from point to point
4. telecast — d. to gain an advantage or victory over
5. curve — e. to broadcast by television
6. relay — f. extension in one direction
7. coaxial — g. the outside of an object or body
8. surface — h. to receive without giving back
9. overcome — i. the opposition offered by a body or substance to the passage through it of a steady electric current
10. drag — j. a cable that consists of a tube of electrically conducting material surrounding a central conductor and is used to send telegraph, telephone, and television signals
11. resistance
12. dimension

(adopted from «Medium and high frequencies for broadcasting» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2

Very low frequencies have little use in radio. They can interfere, however, with radio reception. A doctor's diathermy apparatus, for example, supplies deep heat to tissues inside the body by current that oscillates in the very-low-frequency range. Radiation from the apparatus can reach receivers and be heard. Many other intrusions of the kind commonly called static have very low frequencies.

Long waves with low frequency are used for transoceanic telegraphy and other services that need not carry audio frequencies. To send them, one of the wires that supply oscillations for radiation is connected to the antenna and the other is grounded. This produces a ground wave that is a double, or image, of the antenna wave. Part of each wave goes through the air and the other part along the ground.

The ground waves follow the curved surface of the Earth. They provide most of the energy that reaches receivers, up to the limit they can travel—from 50 to 100 miles (80 to 160 kilometers), depending upon the design and power of the transmitter, the frequency, and the transmitting characteristics of the soil. Salt water is 5,000 times better than dry earth for transmitting ground waves. Hence they can travel great distances at sea.

Reflected low-frequency waves: A portion of the radiation known as the sky wave radiates outward and upward to the ionosphere in the upper atmosphere. As a result of the sun's radiation, the ionosphere contains many ionized (electrified) particles. These react to low-frequency waves by reflecting them back to the Earth. This provides reception beyond the distance reached by the ground wave. Between the two receptions there may be a skip area, or dead zone, where the station cannot be heard.

The sky wave from a very powerful transmitter can be reflected several times between the ionosphere and the Earth. This multiple reflection carries high-power, low-frequency waves across the oceans.

(adopted from «Low frequencies» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numbers.

Exercise 2. What do the proper names and numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Very low frequencies are widely used in radio.
2. Long waves with low frequency are used for transoceanic telegraphy.
3. Two wires are connected to the antenna and the third is grounded.
4. A ground wave goes through the air.
5. The ground waves follow the curved surface of the Earth.
6. The sky wave radiates outward and upward to the ionosphere in the upper atmosphere.
7. Between the two receptions there may be a dead zone, where the station cannot be heard.

Exercise 4. Answer the following questions:

1. How does a doctor/s diathermy apparatus work?
2. Which frequencies do static intrusions have?
3. What are long waves with low frequencies used for?
4. How are the long waves sent?
5. Why does ionosphere contain many ionized particles?
6. What do electrified particles do with low-frequency waves?
7. Where can't the station be heard?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. reception — a. the process of giving off radiant energy in the form of waves or particles
2. supply — b. a line of wire for conducting electrical current

3. oscillate	c.	a device (as a rod or wire) for sending or receiving radio waves
4. intrusion	d.	the receiving of a radio or television broadcast
5. range	e.	force or energy that is or can be applied to work
6. static	f.	one of the very small parts of matter (as a molecule, atom, or electron)
7. wire	g.	the part of the earth's atmosphere beginning at an altitude of about 30 miles (50 kilometers) and extending outward that contains free electrically charged particles
8. antenna	h.	relating to bodies at rest or forces that are balanced
9. power	i.	to swing backward and forward like a pendulum
10. particle	j.	to bend or throw back waves of light, sound, or heat
11. reflect		
12. ionosphere		

Part 3

High frequencies can also be received at long distances, even though the ions in the ionosphere will not reflect the waves. Instead, the ions bend, or refract, the waves. Not all of the high-frequency radio waves that reach the ionosphere are refracted. If a radio signal hits the ionosphere at too great an angle, it will simply penetrate the ionosphere and continue into space. If it hits the ionosphere at too small an angle, it will be absorbed by the ionosphere. However, at a certain angle of incidence, called the critical angle, the signal will be refracted by the ionosphere and bent back down to Earth.

The effect that the ionosphere has on radio signals depends not only on the angle of incidence of the signal but also on the frequency of the signal and the time of day at which the signal is sent. The charged particles, or ions, in the atmosphere are formed when photons of the sun's ultraviolet and X-ray radiation excite atoms of atmospheric gas and dislodge electrons. In times of darkness, the electrons and ions recombine, thereby changing the reflective and refractive properties of the atmosphere.

To assure refraction by the ionosphere, radio signals must be broadcast at the right frequency, time, and angle. Sometimes the signal is reflected by the Earth back to the ionosphere, where it is again refracted and bent back down to Earth. Such multiple reflections, called multihop propagation, can allow radio signals to be picked up and heard for many thousands of miles.

Most long-distance ionospheric propagation takes place using the upper layers of the ionosphere. The lowest layer is used in scatter propagation, or transmission. Signals of the very-high or ultra-high frequency ranges encounter turbulence in the lower atmosphere. These signals scatter randomly in all directions. Although much of the signal is lost in unwanted directions, this type of propagation can be very reliable if powerful transmitters are used.

(adopted from «Achieving distance with high frequencies» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

ionosphere	angle	transmitter	ion	electron

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The ions bend, or refract, the waves.
2. All of the high-frequency radio waves that reach the ionosphere are refracted.
3. If a radio signal hits the ionosphere at too small an angle, it will simply penetrate the ionosphere and continue into space.
4. In times of darkness, the electrons and ions recombine.
5. To assure refraction by the ionosphere, radio signals must be broadcast only at the right frequency.
6. Sometimes the signal is reflected by the Earth back to the ionosphere.
7. The lowest layer of ionosphere is used for transmission.

Exercise 4. Answer the following questions:

1. What do the ions do with the waves?
2. What happens if a radio signal hits the ionosphere at too great an angle?
3. What happens if a radio signal hits the ionosphere at too small an angle?
4. When will the signal be refracted and bent back down to Earth?
5. How are the charged particles formed?
6. What should be done to assure refraction by the ionosphere?
7. Where is the lowest layer of ionosphere used?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. distance	a.	to cause to go through refraction
2. ion	b.	being or relating to a state or point at which a definite change occurs
3. refract	c.	the smallest particle of an element that has the properties of the element and can exist either alone or in combination
4. angle	d.	irregular atmospheric motion with up and down currents
5. critical	e.	the space or amount of space between two points, lines, surfaces, or objects

6. photon — f. an elementary particle that has a negative charge of electricity and travels around the nucleus of an atom
7. atom — g. an atom or group of atoms that carries a positive or negative electric charge as a result of having lost or gained one or more electrons
8. electron — h. the spreading of something
9. propagation — i. a tiny particle or bundle of electromagnetic radiation
10. turbulence — j. to separate and go in different directions
11. scatter
12. powerful

Unit 4. Inductance and Inductive Reactance

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Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) When the current decreases it returns the energy
b) An inductive circuit stores energy when the current increases.
c) Both of them work differently.
d) Energy is stored and released by both kinds of reactors (capacitors and inductors).
e) A capacitive circuit stores energy when the applied voltage increases.
f) When the voltage decreases the circuit restores the energy.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1) A coil's reactance / of alterneting current / increases for / because / in the amount of current / these frequencies / have / rapid changes.
2) that will pass / audio-frequency current / A coil / offers / or reactance / quite readily / great opposition / to a radio-frequency current
3) a radio-frequency / choke / Such a coil / called / can be.
4) but passes / It blocks / the radio-frequencies / when both / audio-frequencies / to the same circuit / are supplied.

Exercise 3. Fill in the gaps with the words from the box and read the whole paragraph.

block	capacitor	charge	current	frequency	opposition
reactance	source	voltage			

A capacitor's 1____________ increases for low frequencies of alternating 2_____________. Low frequency gives time in each pulse for the capacitor to 3_____________ and discharge sufficiently to follow closely the 4_____________ changes at the source. While doing so it opposes these changes, and the 5_____________ cuts down current. This effect increases with lower frequencies until at zero 6_____________ —that is, with direct current—the capacitor becomes charged sufficiently to make its emf equal to that of the source. Then current cannot flow. Thus a 7_____________ is said to block direct current.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. reactor — a. a point where something begins
2. alternating current — b. very fast
3. reactance — c. a device for the controlled release of nuclear energy (as for producing heat)
4. capacitor — d. an electric current that reverses its direction at regular intervals
5. inductor — e. an electromagnetic wave or a sound wave lasting only a short length of time
6. source — f. to slow down or stop the progress of
7. charge — g. to relieve of a charge
8. pulse — h. a part of an electrical device that acts upon another or is itself acted upon by induction
9. discharge — i. to give an electric charge to
10. choke — j. a device for storing electric charge called also condenser
11. rapid
12. block

(adopted from «Contrasting effects of reactances» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2

If the current in a wire is suddenly shut off, the field collapses into the wire. While it is doing this, it drives current in the wire. Since energy is needed to drive current, the field plainly had energy stored in it. Since the energy drives current as it returns to the circuit, it is equivalent in effect to a source of emf.

The energy that is restored in this way had to be supplied when current was built up in the circuit. This action also affects current. As rising current supplies energy to the field of an inductor, the field around each turn of wire expands across adjoining turns. As the field crosses these turns, it induces emf in them. This induced emf acts to oppose the rise of current.

Because of this opposition to the circuit emf, the current rises less and falls less than it would without the inductor. (The fact that induced emf opposes current change is called Lenz's law.) These effects are often compared to a flywheel, because a flywheel stores and returns energy when a mechanical system speeds up and slows down.

An inductor has high inductance when it can store a large amount of energy with only small current flowing through it. Inductance is increased by anything that tends to increase or concentrate the magnetic field. Forming the wire into a coil and placing iron within the coil increase inductance greatly. Inductance is measured in henries.

When a coil carrying alternating current is near a coil in another circuit, the changing field of the first circuit creates corresponding current changes in the other circuit by inductive coupling. The two coils form a transformer.

The field changes that induce emf arise from change (not strength) of current. It is the change of current that makes the field expand and shrink and produce induced emf. The field change is least when the current is poised at maximum between rise and fall. It is greatest when the current is at zero and going through the great change of reversing direction.

(adopted from «Voltage and current changes in inductance» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

current	emf	oscillator	field	tube

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. If the current in a wire is suddenly shut off, the field collapses into the wire.
2. Since energy is needed to drive current, the field plainly had energy stored in it.
3. As the current crosses these turns, it induces emf in them.
4. This induced emf acts to oppose the fall of current.
5. Inductance is increased by anything that tends to increase or concentrate the magnetic field.
6. Inductance is measured in hertz.
7. The two coils form a transformer.

Exercise 4. Answer the following questions:

1. When does the field collapse into the wire?
2. What does rising current supply?
3. Where does the field around each turn of wire expand?

4. What does the field do as it crosses these turns?
5. How does the induced emf act?
6. Why are the current's rises and falls compared to a flywheel?
7. What is inductance measured in?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. collapse	a. a heavy wheel for regulating the speed of machinery
2. field	b. alike or equal in number, value, or meaning
3. restore	c. the act of bringing or coming together
4. equivalent	d. to suddenly lose value or effectiveness
5. induce	e. made or operated by a machine or machinery
6. emf	f. a region or space in which an effect (as gravity, electricity, or magnetism) exists
7. flywheel	g. to put or bring back into existence or use
8. mechanical	h. to produce (as an electric current) by induction
9. coil	i. to increase in size, number, or amount
10. coupling	j. a number of turns of wire wound around a core (as of iron) to create a magnetic field for an electromagnet or an induction coil
11. expand	
12. maximum	

Part 3

If a charged capacitor is connected to an inductor, it discharges through the inductor and sets up a magnetic field. Then the field collapses, forcing charge upon the capacitor in the reverse direction. When the field is collapsed, the newly charged capacitor discharges back through the inductor, setting up a field again. This field collapses and charges the capacitor as it was originally.

These oscillations can continue for some time. They resemble the vibrations set up when energy is applied to a violin string. The frequency (number of cycles a second) depends upon the amount of inductance and capacitance in the circuit. Such a circuit can be adjusted to oscillate at almost any desired frequency. It can be kept going vigorously by replacing the energy used up by the resistance of the wiring. Reactances themselves use little energy; they store and release it.

A transformer and inductance-capacitance circuit are commonly used to select, or tune in, a desired radio broadcast. Radio waves from many stations keep current at many frequencies traveling up and down through the antenna coil. The transformer transfers this energy to the tuning circuit. This circuit will oscillate vigorously if and only if some of this energy is coming to it at its natural frequency. This can be arranged by adjusting the capacitor so that the natural frequency of the tuner circuit is the same as that of the carrier wave that is bringing the desired broadcast.

The tuning circuit passes energy at the selected frequency to the rest of the set. Either a coil or a capacitor gives energy to a circuit in the form of emf (voltage). They do so here and at the resonant frequency because they have been adjusted to oscillate vigorously at that frequency. Thus the desired frequency is passed on at maximum strength, and the other frequencies are minimized.

(adopted from «Tuning with reactance» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in the order they appear in the text.

field reactance electricity circuit transistor

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The field collapses, forcing charge upon the capacitor in the reverse direction.
2. This field collapses and discharges the capacitor as it was originally.
3. The newly charged capacitor discharges back through the inductor, setting up a field again.
4. The frequency depends upon the amount of inductance in the circuit.
5. Reactances themselves use much energy; they store and release it.
6. The transformer transfers this energy to the tuning circuit.
7. The tuning circuit passes energy at the selected frequency to the rest of the set.

Exercise 4. Answer the following questions:

1. When does a charged capacitor discharge?
2. What happens to the field?
3. What does the field charge?
4. What do the oscilllations do?
5. What does the frequency depend upon?
6. How much energy do reactances use?
7. Where does the transformer transfer the energy?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. tuning	a. putting something new in the place

2. reverse	b. a device for changing an electric current into one of different voltage
3. oscillation	c. strengthened and enriched by resonance
4. replacing	d. to put (as an engine) in good working order
5. select	e. the number of waves (as of sound or electromagnetic energy) that pass a fixed point each second
6. transformer	f. potential difference measured in volts
7. diagram	g. to pick out from a number or group
8. resonant	h. the action or state of oscillating
9. frequency	i. a drawing, sketch, plan, or chart that makes something clearer or easier to understand
10. circuit	j. opposite or contrary to a previous or normal condition
11. voltage	
12. transfer	

Unit 5. Application of Integrated Circuits

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) Consumer electronicsis is a field that was first developed in the 19th century with the invention of the phonograph.
b) Numerous circuit types are used in a vast array of electronic devices.
c) Electronic controls have also been added to many electrical appliances such as dishwashers, washing machines, ovens, and food processors.
d) Now it includes radios, television sets, high-fidelity stereo systems, digital video disc (DVD) players, MP3 players, cellular telephones, calculators, video games, and personal computers.
e) Most of these devices contain one or more integrated circuits.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1) from one to / integrated circuits / several thousand / Computer / is made up of.
2) it has become / In industry and trade / controlling / and keeping / industrial operations / business records / track of voluminous / an invaluable tool.
3) connected to / and grippers / When / mechanical arms / is the brain / electronics / robot / of the industrial.

4) Robots / into / widespread use / and welding / for painting / have come / increasingly.
5) assemble products / to watches / from automobiles / They also / that range.

Exercise 3. Fill in the gaps with the words from the box and read the whole paragraph.

actual complex computers diagnose distant equipment measurements oscilloscope packed

Scientists use electronic 1___________to perform extremely 2___________ calculations such as determining exactly the course of 3____________space probes; the probes themselves are packed with electronic instruments and communications 4___________. Electronic instruments are used on Earth for scientific 5____________and in the electronics industry itself to test equipment as it is manufactured. The 6____________, for example, is used to diagnose problems in electronic circuits through a comparison of expected patterns with 7____________results.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1.	array	a.	something used in doing one's job
2.	consumer	b.	to put into action or effect
3.	phonograph	c.	a number or collection of different things
4.	cellular	d.	having or marked by great volume or bulk
5.	tool	e.	being a radiotelephone system in which a geographical area (as a city) is divided into small sections each served by a transmitter of limited range
6.	voluminous	f.	being at a great distance
7.	perform	g.	an instrument that reproduces sound recorded on a grooved disk
8.	distant	h.	a device used to penetrate or send back information especially from outer space
9.	probe	i.	an instrument in which the variations in a continually changing electrical quantity appear temporarily as a visible wave form on the screen of a cathode-ray tube
10.	measurement	j.	the act or process of measuring
11.	oscilloscope		
12.	diagnose		

(adopted from «Computers» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Part 2

Electronic devices are used in a great many applications. Integrated circuits are extremely versatile because a single basic design can be made to perform a myriad of different functions, depending on the wiring of the circuits and the electronic programs or instructions that are fed into them (computer). Most integrated circuits perform calculations or logic manipulations in devices ranging from handheld calculators to ultrafast supercomputers that can perform trillions of calculations per second.

There are many other functions, however, that can be done with electronic circuitry. In radio and television receivers a primary function of circuits is the amplification of weak signals received by the antenna. In amplification a small signal is magnified to a large signal that is used to drive other circuits such as the speakers of a radio.

In many cases this amplification is performed with the help of oscillator circuits. Such a circuit has a natural period, or cycle, of electrical current, similar to the natural beat of a pendulum. When driven by external signals of the same period, such as the transmission from a particular radio channel, the oscillator circuit increases its amplitude of oscillation.

To tune out other radio or television stations also received by a single antenna, filter circuits are frequently used. Such filters strongly reduce the signals at all but a single frequency, preventing interference among channels in a receiver.

(adopted from «Radio and Television» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

vacuum integrated circuit amplification function coil

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Electronic devices are used in some applications.
2. Integrated circuits can perform a myriad of different functions.
3. Most integrated circuits perform calculations or logic manipulations.
4. In radio and television receivers a primary function of circuits is to perform calculations.
5. In amplification a small signal is magnified to a large signal.
6. This amplification is performed with the help of antenna.
7. Such a circuit has a natural period of electrical current, similar to the natural beat of a pendulum.

Exercise 4. Answer the following questions:

1. Where are electronic devices used?
2. Why are integrated circuits extremely versatile?

3. What is the role of most integrated circuits?
4. What are the circuits in radio and television used for?
5. What is a large signal used for?
6. How is the amplification performed?
7. When does the oscillator circuit increase its amplitude of oscillation?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. application	a. the arrangement of circuit elements (as in a computer) needed for computation
2. versatile	b. ability to be put to practical use
3. myriad	c. able to do many different kinds of things
4. calculation	d. an act, example, or product of amplifying
5. logic	e. the plan or the elements of an electric circuit
6. circuitry	f. a device (as a rod or wire) for sending or receiving radio waves
7. primary	g. a large but not specified or counted number
8. amplification	h. the process or an act of calculating
9. external	i. the passage of radio waves in the space between transmitting and receiving stations
10. transmission	j. circuit that is connected to the source of electricity in an induction coil or transformer
11. radio channel	
12. antenna	

Part 3

In the field of medicine electronic diagnostic instruments have given physicians a much clearer view of the human body than ever before. Computed tomography (CT) scanners, for example, use computers to analyze X-rays and produce three-dimensional views of internal organs. Nuclear magnetic resonance (NMR) scanners analyze the response of the body's chemicals to radio waves and magnetic fields, producing maps of the body's biochemistry and clearly highlighting areas of disease.

Virtually all modern communications rely on electronics. Electronic circuits switch telephone calls both on Earth and in communications satellites. Satellite electronics systems amplify and retransmit television and radio communications. Computers are tied together by electronic networks.

Conventional electronics is now supplemented in communications by optoelectronics, the use of light carried by optical fibers to transmit information at

high speed. Laser pulses are modulated by electronic signals and the light at the other end of the fiber many miles or kilometers away is converted back into electronic signals by photodetectors.

Electronics has also come to play a central role in transportation. Integrated circuits are used in the engines of almost all new cars, acting to control the engine and to use fuel efficiently. Much more complex circuits and computers greatly assist pilots in flying aircraft and are, of course, even more vital when used in spacecraft.

Finally, electronics has come to be central in modern warfare and preparations for war. A large part of the cost of advanced fighter aircraft is in the sophisticated electronic radar, weapons control, and automated missiles carried by the planes. Electronic computers and navigation equipment guide ballistic nuclear missiles on their paths and control the detonation of nuclear weapons.

(adopted from «Medicine and Industry» Britannica Student Library. Encyclopedia Britannica. Chicago: Encyclopedia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

antenna	communication	electronics	transistor	industry

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?
1. Computed tomography scanners use computers to analyze X-rays and produce two-dimensional views of internal organs.
2. Nuclear magnetic resonance scanners highlight areas of disease.
3. Virtually all modern communications rely on electronics.
4. Telephones are tied together by electronic networks.
5. Laser pulses are modulated by electronic signals.
6. Electronics has come to play a minor role in transportation.
7. Electronics has come to be central in modern warfare and preparations for war.

Exercise 4. Answer the following questions:
1. Why do computed tomography scanners use computers?
2. What do NMR scanners do?
3. What are modern communications rely on?
4. Where are satellite electronics systems used?
5. How are computers tied together?
6. What is optoelectronics?
7. Why are integrated circuits used in cars?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. physician	a. extension in three directions
2. X-rays	b. a device that sends out radio waves for detecting and locating an object by the reflection of the radio waves and that may use this reflection to find out the position and speed of the object
3. scanner	c. one educated and licensed to practice medicine
4. three dimensional	d. a machine that changes energy into mechanical motion
5. network	e. an electromagnetic radiation of an extremely short wavelength that is able to penetrate various thicknesses of solids and to act on photographic film as light does
6. optical fiber	f. a device that uses the natural vibrations of atoms or molecules to generate a narrow beam of light having a small frequency range
7. transmit	g. a single fiber-optic strand
8. laser	h. a radio wave or electric current that transmits a message or effect
9. signal	i. a device for scanning a living body to collect medical information
10. engine	j. a system of computers connected by communications lines
11. sophisticated	
12. radar	

Unit 6. Chaos Theory

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) He published an influential study of the chaotic motion of a free particle gliding frictionlessly on a surface of constant negative curvature in 1898.
b) The first discoverer of chaos can plausibly be argued to be Jacques Hadamard.
c) In the early 1900s Henri Poincaré found that there. can be orbits which are nonperiodic, and yet not forever increasing nor approaching a fixed point.
d) In the system studied, Hadamard was able to show that all trajectories are unstable.

e) In this system all particle trajectories diverge exponentially from one another, with a positive Lyapunov exponent.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1) was developed / almost / Much of the early theory / under the name of / entirely by mathematicians / ergodic theory.
2) also / Later studies / were carried out by / on the topic of / nonlinear differential equations / and Stephen Smale / G.D. Birkhoff, A.N. Kolmogorov, M.L. Cartwright, J.E. Littlewood.
3) these studies / inspired by physics / Except for Smale / were all directly.
4) was / The three-body problem / Birkhoff / in the case of.
5) in the case of / and astronomical problems / Turbulence / was / Kolmogorov.
6) engineering / Radio / in the case of / was / Cartwright and Littlewood.

Exercise 3. Fill in the gaps with the words from the box and read the whole paragraph.

catalyst chaotic circuits electronic formulas linear logistic theory turbulence

Although 1___________planetary motion had not been observed, experimentalists had encountered 2____________ in fluid motion and nonperiodic oscillation in radio 3____________ without the benefit of a theory to explain what they were seeing. Chaos theory progressed more rapidly after mid-century, when it first became evident for some scientists that 4____________ theory, the prevailing system theory at that time, simply could not explain the observed behaviour of certain experiments like that of the 5___________ map. The main 6____________for the development of chaos theory was the electronic computer. Much of the mathematics of chaos theory involves the repeated iteration of simple mathematical 7____________, which would be impractical to do by hand. Electronic computers made these repeated calculations practical. One of the earliest electronic digital computers, ENIAC, was used to run simple weather forecasting models.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. discover	a. the curve that a body (as a planet in its orbit or a rocket) travels along in space
2. motion	b. remaining steady and unchanged
3. frictionlessly	c. an act or process of changing place or position
4. constant	d. charged with positive electricity : having a deficiency of electrons

5.	trajectories	e.	without rubbing of one thing against another
6.	diverge	f.	the path taken by one body circling around another body
7.	positive	g.	to obtain sight or knowledge of for the first time
8.	orbit	h.	to calculate or predict (a future event or state) usually by study and examination of data
9.	chaos theory	i.	someone or something that causes or speeds significant change or action
10.	forecasting	j.	to move or extend in different directions from a common point
11.	catalyst		
12.	nonperiodic		

(adopted from «Chaos theory.» http://en.wikipedia.org/w/index.php?title=Chaos_theory&oldid=165987432)

Part 2

In mathematics and physics, chaos theory describes the behavior of certain nonlinear dynamical systems that under specific conditions exhibit dynamics that are sensitive to initial conditions (popularly referred to as the butterfly effect). As a result of this sensitivity, the behavior of chaotic systems appears to be random, because of an exponential growth of perturbations in the initial conditions. This happens even though these systems are deterministic in the sense that their future dynamics are well defined by their initial conditions, and with no random elements involved. This behavior is known as deterministic chaos, or simply chaos.

Chaotic behavior has been observed in the laboratory in a variety of systems including electrical circuits, lasers, oscillating chemical reactions, fluid dynamics, and mechanical and magneto-mechanical devices. Observations of chaotic behaviour in nature include the dynamics of satellites in the solar system, the time evolution of the magnetic field of celestial bodies, population growth in ecology, the dynamics of the action potentials in neurons, and molecular vibrations. Everyday examples of chaotic systems include weather and climate. There is some controversy over the existence of chaotic dynamics in the plate tectonics and in economics.

Systems that exhibit mathematical chaos are deterministic and thus orderly in some sense; this technical use of the word chaos is at odds with common parlance, which suggests complete disorder. A related field of physics called quantum chaos theory studies systems that follow the laws of quantum mechanics. Recently, another field, called relativistic chaos, has emerged to describe systems that follow the laws of general relativity.

(adopted from «Chaos theory.» http://en.wikipedia.org/w/index.php?title=Chaos_theory&oldid=165987432)

Exercise 1. Look through the text and define which of the following key words are mentioned in it. Put them in order they appear in the text.

chaos behavior gravity observation relativity

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. In mathematics and physics, chaos theory describes the behavior of certain nonlinear dynamical systems.
2. This behavior is known as the butterfly effect.
3. Chaotic behavior has been observed in the laboratory only in electrical circuits and lasers.
4. Observations of chaotic behaviour in nature include the dynamics of satellites in the solar system.
5. Everyday examples of chaotic systems include weather and climate.
6. A related field of physics called electromagnetic wave theory studies systems that follow the laws of quantum mechanics.
7. Relativistic chaos, has emerged to describe systems that follow the laws of general relativity.

Exercise 4. Answer the following questions:

1. What does chaos theory describe?
2. How do chaotic systems behave?
3. Why is the behavior of chaotic systems random?
4. How is this behavior called?
5. Where has chaotic behavior been observed?
6. What do observations of chaotic behavior in nature include?
7. What is relativistic chaos?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1.	chaos	a.	existing at the beginning
2.	device	b.	involving an exponent
3.	dynamics	c.	a substance tending to flow or take the shape of its container
4.	initial	d.	a piece of equipment to serve a special purpose
5.	exponential	e.	relating to the sky
6.	perturbation	f.	the science of the motion of bodies and the action of forces in producing or changing their motion
7.	fluid	g.	a heavenly body orbiting another of larger size
8.	satellite	h.	complete confusion

9. celestial	i.	mechanics relating to the principles of quantum theory
10. neuron	j.	the action of perturbing
11. relativity		
12. quantum mechanics		

Part 3

An early pioneer of the theory was Edward Lorenz whose interest in chaos came about accidentally through his work on weather prediction in 1961. Lorenz was using a basic computer, a Royal McBee LGP-30, to run his weather simulation. He wanted to see a sequence of data again and to save time he started the simulation in the middle of its course. He was able to do this by entering a printout of the data corresponding to conditions in the middle of his simulation which he had calculated last time.

To his surprise the weather that the machine began to predict was completely different from the weather calculated before. Lorenz tracked this down to the computer printout. The printout rounded variables off to a 3-digit number, but the computer worked with 6-digit numbers. This difference is tiny and the consensus at the time would have been that it should have had practically no effect. However Lorenz had discovered that small changes in initial conditions produced large changes in the long-term outcome.

Yoshisuke Ueda independently identified a chaotic phenomenon as such by using an analog computer on November 27, 1961. The chaos exhibited by an analog computer is a real phenomenon, in contrast with those that digital computers calculate, which has a different kind of limit on precision. Ueda's supervising professor, Hayashi, did not believe in chaos throughout his life, and thus he prohibited Ueda from publishing his findings until 1970.

The availability of cheaper, more powerful computers broadens the applicability of chaos theory. Currently, chaos theory continues to be a very active area of research.

(adopted from «Chaos theory.» http://en.wikipedia.org/w/index.php?title=Chaos_theory&oldid=165987432)

Exercise 1. Look through the text and copy out proper names and numbers.

Exercise 2. What do the proper names and numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. An early pioneer of the chaos theory was Yoshisuke Ueda.
2. Lorenz was using a basic computer, a Royal McBee LGP-30.

3. To his surprise the weather that the machine began to predict was the same as the weather calculated before.
4. Lorenz had discovered that small changes in initial conditions produced large changes in the long-term outcome.
5. The chaos exhibited by an analog computer is a real phenomenon, in contrast with those that digital computers calculate.
6. Ueda's supervising professor, Lorenz, did not believe in chaos throughout his life.
7. Currently, chaos theory continues to be a very active area of research.

Exercise 4. Answer the following questions:

1. Who was an early pioneer of chaos theory?
2. What did Lorenz do?
3. How did he run his weather simulation?
4. What was the result of Lorenz's weather prediction?
5. What did Lorenz discover?
6. When did Ueda identify a chaotic phenomenon?
7. What continues to be a very active area of research?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. pioneer	a.	information in numerical form for use especially in a computer
2. prediction	b.	to forbid by authority
3. simulation	c.	an observable fact or event
4. data	d.	producing a printed record of
5. calculate	e.	the imitation by one system or process of the way in which another system or process works
6. printout	f.	to come about as an effect, consequence, or conclusion
7. outcome	g.	an act of predicting
8. identify	h.	a person or group that explores new areas of thought or activity
9. phenomenon	i.	being put to use or put into practice
10. limit	j.	to find by performing mathematical operations (as addition, subtraction, multiplication, and division)
11. prohibit		
12. applicability		

Unit 7. Examples of Chaotic Systems

Part 1

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) Dynamical billiards may also be studied on non-Euclidean geometries; indeed, the very first studies of billiards established their ergodic motion on surfaces of constant negative curvature.
b) A billiard is a dynamical system in which a particle alternates between motion in a straight line and specular reflections off of a boundary.
c) When the particle hits the boundary it reflects from it without loss of speed.
d) The study of billiards which are kept out of a region, rather than being kept in a region, is known as outer billiard theory.
e) Billiard dynamical systems are Hamiltonian idealizations of the game of billiards, but where the region contained by the boundary can have shapes other than rectangular and even be many dimensional.

Exercise 2. Put the words and phrases of the given sentences into the proper order and read the whole paragraph.

1) in the billiard / The motion of the particle / with constant energy / is a straight line / with the boundary / between reflections.
2) are / All reflections / specular.
3) just before the collision / is equal to / the angle of reflection / The angle of incidence / just after the collision.
4) is called / The sequence / the billiard map / of reflections.
5) completely / the motion of the particle / This sequence / characterizes.

Exercise 2. Fill in the gaps with the words from the box and read the whole paragraph.

billiards chaos dimensional elliptic equations equivalent integrability motion phase

1___________capture all the complexity of Hamiltonian systems, from 2____________ to chaotic motion, without the difficulties of integrating the 3____________ of motion to determine its Poincaré map. Birkhoff showed that a billiard system with an 4_____________ table is integrable. In one dimension billiards (i.e. hard rods) show deterministic 5_____________ and are ergodic if they have different masses. The mathematical problem of one 6_____________ billiards of different masses and a single billiard in a flat-sided box are equivalent. The chaotic property means billiards are extremely efficient samplers of their 7___________space.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the words with their definitions.

1. alternate	a. an act or instance of colliding
2. boundary	b. occurring first on one side and then on the other at different levels along an axis
3. reflection	c. to form or unite into a whole
4. curvature	d. something that points out or shows a limit or end : dividing line
5. outer	e. the production of an image by or as if by a mirror
6. incidence	f. having the shape of an ellipse
7. collision	g. consisting of one
8. capture	h. located on the outside or farther out
9. integrating	i. a special quality of something
10. elliptic	j. the act of curving : the state of being curved
11. single	
12. property	

(adopted from http://en.wikipedia.org/w/index.php?title=Dynamical_billiards&oldid=165759363)

Part 2

Chua's circuit is a simple electronic circuit that exhibits classic chaos theory behavior. It was introduced in 1983 by Leon O. Chua, who was a visitor of Waseda University (Japan) at that time.. The ease of construction of the circuit has made it a ubiquitous real-world example of a chaotic system, leading some to declare it 'a paradigm for chaos'

An autonomous circuit made from standard components (resistors, capacitors, inductors) must satisfy three criteria before it can display chaotic behaviour. It must contain:
one or more nonlinear elements
one or more locally active resistors
three or more energy-storage elements.

By means of the application of the laws of electromagnetism, the dynamics of Chua's circuit can be accurately modeled by means of a system of three nonlinear ordinary differential equations in the variables x(t), y(t) and z(t), which give the voltages in the capacitors C1 and C2, and the intensity of the electrical current in the inductance L1, respectively.

A chaotic attractor, known as «The Double Scroll» because of its shape in the (x,y,z) space, was first observed in a circuit containing a nonlinear element such that f(x) was a 3-segment piecewise-linear function. The easy experimental implementation of the circuit, combined with the existence of a simple

and accurate theoretical model, makes Chua's circuit a useful system to study many fundamental and applied issues of chaos theory. Because of this, it has been object of much study, and appears widely referenced in the literature.
(adopted from http://en.wikipedia.org/w/index.php?title=Chua%27s_circuit&oldid=157485220)

Exercise 1. Look through the text and copy out proper names and numbers.

Exercise 2. What do the proper names and numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?
1. Chua's circuit is a complex electronic circuit that exhibits classic chaos theory behavior.
2. The circuit was introduced in 1983 by Leon O. Chua.
3. The circuit made from standard components must satisfy five criteria before it can display chaotic behaviour.
4. The dynamics of Chua's circuit can be accurately modeled by means of a system of three nonlinear ordinary differential equations.
5. It must contain three or less energy-storage elements.
6. The easy experimental implementation of the circuit makes it a useful system to study many fundamental and applied issues of chaos theory.
7. Because of this it appears widely referenced in the literature.

Exercise 4. Answer the following questions:
1. What is Chua's circuit?
2. When was it introduced?
3. What are the components of autonomous circuit?
4. How can the dynamics of Chua's circuit be modeled?
5. Where was a chaotic attractor first observed?
6. Why was this circuit object of much study?
7. Where does it appear widely referenced?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. introduce	a. existing independent of anything else
2. construction	b. an example showing how something is to be done
3. ubiquitous	c. to bring into practice or use
4. paradigm	d. the act of realization
5. autonomous	e. to make clear the existence or presence of
6. display	f. relating to or having the character of theory
7. storage	g. the process, art, or manner of constructing

8. variable	h. a mathematical symbol representing a variable
9. intensity	i. the act of storing : the state of being stored
10. theoretical	j. existing or being everywhere at the same time : constantly encountered
11. accurate model	
12. implementation	

Part 3

The standard (or Taylor-Chirikov) map is an area preserving chaotic map from a square with the side 2π into itself. It is defined by:

$p_{n+1} = p_n + K \sin(\theta_n)$

$\theta_{n+1} = \theta_n + p_{n+1}$

where pn and θn are taken modulo 2π. This map describes the motion of a simple mechanical system called a kicked rotator. This is made by a stick that is free of the gravitational force, it can rotate frictionless in a plane around an axis located in one of its tips, and is periodically kicked in the other tip. The variables θ_n and pn determine, respectively, the angular position of the stick and its angular momentum after the n-th kick. The constant K measures the intensity of the kicks.

Besides the kicked rotator, the standard map also describes other systems in the fields of mechanics of particles, accelerator physics, plasma physics, and solid state physics. However, this map is interesting from a fundamental point of view in physics and mathematics because it is a very simple model of a conservative system that displays hamiltonian chaos. It is therefore useful to study the development of chaos in this kind of systems.

For K=0 the map is linear and only periodic and quasiperiodic orbits are allowed. When ploted in phase space (the θ-p plane), periodic orbits appear as closed curves, and quasiperiodic orbits as necklaces of closed curves whose centers lie in another larger closed curve. Which type of orbit is to be observed depends on the map initial conditions.

Nonlinearity of the map increases with K, and with it the possibility to observe chaotic dynamics for appropriate initial conditions.
(adopted from http://en.wikipedia.org/w/index.php?title=Standard_map&oldid=123762781)

Exercise 1. Look through the text and copy out proper names and numbers.

Exercise 2. What do the proper names and numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?
1. The standard map is an area preserving chaotic map from a square with the side π into itself.

2. This map describes the motion of a simple mechanical system called a kicked rotator.
3. This is made by a stick that is free of the gravitational force.
4. The constant K measures the intensity of rotations.
5. This map is interesting from a fundamental point of view in physics and mathematics.
6. It is a very complex model of a conservative system that displays hamiltonian chaos.
7. Which type of orbit is to be observed depends on the map initial conditions.

Exercise 4. Answer the following questions:
1. What is the standard map?
2. What does this map describe?
3. How does the kicked rotator work?
4. What else does the standard map describe besides the kicked rotator?
5. Why is the standard map interesting from the point of view in physics and mathematics?
6. Which orbits are allowed for K=0?
7. How do periodic and quasiperiodic orbits appear?

Exercise 5. Look through the text and give the title to it.

Exercise 6. Match the words with their definitions.

1. chaotic	a. a straight line about which a body or a geometric figure rotates or may be supposed to rotate
2. rotator	b. a device that is used to give high velocities to charged particles
3. gravitational force	c. the act, process, or result of developing
4. axis	d. to watch carefully
5. angular	e. being in complete confusion
6. accelerator	f. something which turns about an axis or a center
7. plasma	g. a force of attraction that tends to draw particles or bodies together
8. solid	h. measured by an angle
9. development	i. occurring at regular intervals
10. periodic	j. a collection of charged particles that shows some characteristics of a gas but that differs from a gas in being a good conductor of electricity and in being affected by a magnetic field
11. curve	
12. observe	

8. READING ROOM FOR STUDENTS OF PHYSICS

Unit 1. Place of physics in the Modern World

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a) Plasmas are produced in the laboratory by applying a high voltage (100 to 100,000 volts) across a tenuous gas contained within a rigid metal or ceramic vacuum chamber.
b) The gas is said to be ionized.
c) When a gas is heated by many thousands of degrees, the individual atoms collide with enough violence to knock electrons free.
d) This results in a collection of positively charged ions and free, negatively charged electrons.
e) When a sizable number of the atoms become ionized, the gas is called plasma.

Exercise 2. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1) In most instances / that surround the vacuum chamber / flowing through coils / electric currents / to produce / are used / a strong magnetic field.
2) may reach 1,800,000°F / once the gas / or more / The temperature of the gas / is fully ionized.
3) may be supplemented / This method of heating / electrons / and sometimes microwaves / by bombarding the gas / with.
4) the strong electric current / produces / its own magnetic field / Once the plasma is cteated / flowing through it / which circles the plasma current.
5) known as the pinch effect / In a phenomenon / of force / the tension / compresses the plasma column / in the circling lines of force.
6) In addition / resulting / and kink instabilities / in so-called sausage / causes the column to buckle / the pressure of the field.

Exercise 3. Fill in the gaps with the words from the box. Read the whole paragraph.

ability approaches field magnetic methods nuclear plasma power temperature

To counteract these effects, the (1) … field of the external current coil is used to help stabilize and confine the (2) … column. With the proper magnetic-field configuration, plasma physicists had hoped to confine the plasma within the (3) … , away from the cold walls of the chamber, so that the (4) … of the plasma might be raised to temperatures high enough to initiate (5) … fusion. If this were achieved, scientists believe that plasma might one day provide a major share of the world's nuclear power. In practice this goal has proved elusive, however, because of the remarkable (6) … of the plasma to squirm out of the confining magnetic field. Despite a variety of innovative approaches, including exotic magnetic-field configurations and faster (7) … of creating and heating the plasma, the problem remains unsolved.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word and phrase with its definition.

1. gas	a. to come together with solid impact
2. degree	b. to put under the force of rapidly moving particles
3. collide	c. the action of a force against an opposing force
4. electron	d. a fluid (as hydrogen or air) that has no fixed shape and tends to expand without limit
5. ion	e. an elementary particle that has a negative charge of electricity and travels around the nucleus of an atom
6. bombarding	f. a radio wave between one millimeter and one meter in wavelength
7. plasma	g. a collection of charged particles that shows some characteristics of a gas but that differs from a gas in being a good conductor of electricity and in being affected by a magnetic field
8. microwave	h. to lessen the force, action, or influence of
9. pressure	i. one of the divisions marked on a measuring instrument
10. counteract	j. the union of light atomic nuclei to form heavier nuclei resulting in the release of enormous quantities of energy
11. confine	
12. nuclear fusion	

(adopted from «physics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Scientific developments in the early 20th century revolutionized the world's understanding of time, space, and the evolution of the universe. In 1900, German physicist Max Planck explored the concept of blackbody radiation and gave birth to the concept of quantum mechanics, or particle physics. Planck believed that energy was emitted in packets, rather than in a continuous stream. His studies influenced the work of other leading scientists, including fellow German physicist Albert Einstein.

In 1905, Einstein published his special theory of relativity, in which he introduced an entirely new concept: that time and motion are relative to the observer, if the speed of light is constant and natural laws are the same everywhere in the universe. During this time, he also presented his famous formula, E=mc2 (energy equals mass times the speed of light squared), known as the energy-mass relation. From that point on, he was recognized as one of the most important physicists of all time.

In 1916, Einstein published the follow-up to his earlier work—the general theory of relativity. The new theory, which revolutionized scientists' perspectives on gravity and motion, asserted that mass or energy causes the space-time continuum to curve. This theory gave rise to the modern science of cosmology, the study of the evolution of the universe. That same year, German astronomer Karl Schwarzschild used Einstein's general theory of relativity to predict the existence of black holes, which are collapsed stars that emit no radiation.

(adopted from «physics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. What do the proper names and numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Scientific developments in the middle of the 20th century revolutionized the world's understanding of time, space, and the evolution of the universe.
2. In 1900, German physicist Max Planck explored the concept of blackbody radiation.
3. Planck believed that energy was emitted in a continuous stream.
4. Planck's studies influenced the work of German physicist Albert Einstein.
5. In 1905, Einstein published his chaos theory.
6. Einstein presented his famous formula E=mc2.
7. Karl Schwarzschild used Einstein's general theory of relativity to predict the existence of black holes.

Exercise 4. Answer the following questions.

1. What was the result of scientific developments in the early 20th century?
2. Who explored the concept of blackbody radiation?
3. Who gave birth to the concept of quantum mechanics, or particle physics?
4. When did Einstein publish his special theory of relativity?
5. What famous formula did Einstein also present?
6. When did Einstein publish the general theory of relativity?
7. What did Karl Schwarzschild predict?

Exercise 5. Match the word with its definition.

1. evolution	a. relating to the principles of quantum theory
2. universe	b. the whole body of things observed or assumed
3. blackbody	c. something conceived in the mind
4. radiation	d. the act or an instance of following up
5. quantum	e. the history of the development
6. emit	f. a theory in physics that considers mass and energy to be equal and that states that a moving object will experience changes in mass, size, and time which are related to its speed and are not noticeable except at speeds approaching that of light
7. concept	g. a body or surface that absorbs all radiant energy falling upon it with no reflection
8. follow-up	h. something that is continuous and the same throughout and that is often thought of as a series of elements or values which differ by only tiny amounts
9. relativity	i. a branch of astronomy that deals with the beginning, structure, and space-time relationships of the universe
10. gravity	j. to throw or give off or out
11. continuum	
12. cosmology	

Part 3

The radioactive decay of nuclei provides an informative snapshot of nuclear structure. Even greater insight, however, is obtained when nuclei are stimulated by beams of projectiles from a particle accelerator, a machine that speeds up particles by means of electrical forces. Beams of electrons, pions, protons, alpha particles, and ionized nuclei, among others, have been used to produce nuclear reactions. The simplest type of collision process is elastic scattering, in which the target nucleus stays in its ground state after the collision. Elastic scattering, particularly of electrons, has provided detailed information on nuclear sizes and

shapes. Inelastic scattering is used to produce an excited state in a nucleus, enabling the experimenter to study modes of rotation and vibration.

A charge-exchange reaction—in which, for instance, an incident proton turns into a neutron—probes the symmetry between proton and neutron interactions in nuclei. Transfer reactions—in which a proton, neutron, or cluster of nucleons is dumped into (or removed from) a nucleus—reveal to what extent a nuclear state can be considered a single nucleon (or cluster) rotating around a core. Pion scattering processes are sensitive to the presence of the pion exchange force in the nucleus and to the differences in density between protons and neutrons. Reactions with beams of heavy ions (atoms stripped of most of their electrons) have been used to produce nuclei far from the region of maximum stability, and beams of kaons (mesons that possess a quality known as strangeness) enable the experimenter to create hypernuclei, in which a neutron or proton is replaced by a hyperon (a «strange» nucleon).

In the future, nuclear collisions at ever higher energies will be studied, with the aim of producing new particles and other phenomena such as abnormal states of nuclear matter of very high density. Observations of this kind may make it possible for physicists to unravel some of the mysteries and most closely held secrets of nature.

(adopted from «physics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

collision	decay	current	reaction	wave

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The radioactive decay of nuclei provides an informative snapshot of nuclear structure.
2. Accelerator is a machine that slows down particles by means of electrical forces.
3. The simplest type of collision process is elastic scattering.
4. Inelastic scattering has provided detailed information on nuclear sizes and shapes.
5. In a charge-exchange reaction an incident electron turns into a proton.
6. Pion scattering processes are sensitive to the presence of the pion exchange force in the nucleus.
7. In hypernuclei, a neutron or proton is replaced by a hyperon (a «strange» nucleon).

Exercise 4. Answer the following questions.

1. What does the radioactive decay of nuclei provide?
2. What is a particle accelerator?

3. What particles have been used to produce nuclear reactions?
4. Where does the target nucleus stay in its ground state?
5. What happens during the charge-exchange reaction?
6. What have reactions with beams of heavy ions been used for?
7. Which nuclear collisions will be studied in the future?

Exercise 5. Match the word with its definition.

1. decay	a. something (as a bullet or rocket) thrown or driven forward especially from or for use as a weapon
2. nucleus	b. an atomic particle that occurs in the nucleus of every atom and carries a positive charge equal in size to the negative charge of an electron
3. beam	c. an act or process in which something scatters or is scattered
4. projectile	d. to raise (as an atom) to a higher energy level provoke
5. proton	e. a collection of nearly parallel rays (as X-rays) or a stream of particles (as electrons)
6. scattering	f. the mass of a substance per unit volume
7. excite	g. a number of similar things growing, collected, or grouped together
8. neutron	h. the central part of an atom that includes nearly all of the atomic mass and consists of protons and usually neutrons
9. interaction	i. an uncharged atomic particle that has a mass nearly equal to that of the proton and is present in all known atomic nuclei except the hydrogen nucleus
10. cluster	j. a natural decrease in the number of radioactive atoms in radioactive material
11. core	
12. density	

Unit 2. Radiophysics and electronics

Part 1

Exercise 1. Put the sentences into the proper order. Read the whole paragraph.

a) When radio waves are generated, they spread out from the transmitting antenna in all directions at the speed of light—about 186,000 miles (300,000 kilometers) per second.

b) A decade later the German physicist Heinrich Hertz proved the existence of radio waves.
c) Radio messages and signals travel across space by way of electromagnetic waves.
d) The existence of such waves was first postulated in 1873 by the Scottish physicist James Clerk Maxwell.
e) Like water waves, radio waves also radiate away from a center.

Exercise 2. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1) just as the water waves / When the waves / the cause the electrons in the antenna / encounter a receiving antenna / to surge back and forth / to bob up and down / cause objects on the water.
2) The electron surges / in a radio or television / are converted by circuits / to reproduce / the transmitted audio or video signal / into light or sound.
3) can travel / Radio waves / and through vacuum / through the air.
4) radio waves / in straight lines / travel / Like light waves.
5) travel along the ground / the curvature of the Earth / Some of the transmitted waves / and follow.
6) Some of the waves / or bent / and are refracted / travel out to the atmosphere / back to the Earth / called the ionosphere / by layers of ionized gases.
7) allow radio signals / These two paths / over the horizon / to travel.

Exercise 3. Fill in the gaps with the words from the box. Read the whole paragraph.

charge direction distance forces magnetic radiator spreads substance wave

No particles of water, air, or any other (1) … going through back-and-forth motions or moving in one (2) … can carry radio signals. A radio (3) … is a special combination of electric and (4) … forces. These forces can be seen at work with commonplace objects. A magnet (5) … energy through space to pick up iron filings, tacks, and other light bits of iron. Rubbing a comb with wool gives it an electric charge. This charge reaches across space and attracts or picks up bits of paper. A radio wave is made of these same electric and magnetic (6) … , but it is sent from an antenna or (7) … with power enough to go a long distance through space and penetrate solid structures.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word and phrase with its definition.

1. electromagnetic wave	a. an electromagnetic wave with radio frequency
2. postulate	b. to move in or as if in waves

3. radio wave	c. the energy of vibration that causes the sensation of hearing
4. antenna	d. a space completely empty of matte
5. generate	e. to claim as true: assume as a postulate
6. surge	f. physical material from which something is made
7. sound	g. a wave (as a radio wave, wave of visible light, or X-ray) that consists of an associated electric and magnetic effect and travels at the speed of light
8. vacuum	h. one that radiates
9. substance	i. a mass of iron or steel so treated that it has this property
10. magnet	j. to bring into existence
11. radiator	
12. solid	

(adopted from «electronics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Radio aroused worldwide excitement in December 1901, when Guglielmo Marconi received the first transatlantic radio signals in St. John's, Newf. The wireless signals were sent from a transmitter in England. In the earliest practical application, radio was used primarily to exchange messages with ships at sea. Radio is still used for this purpose and for communication across oceans.

Most local telephone communication is carried by electrical signals in coaxial cable systems, though long-distance calls are often made with radio signals. In radio telephones such as cellular mobile telephones, voice signals are sent across town or over long distances by high-frequency radio signals called microwaves. Land-based microwave relay stations and communication satellites orbiting the Earth receive and transmit the microwave signals.

Radio technology is not limited to the transmission of audio signals. Video signals from television cameras are sent by radio waves as well. Radio technology is used to send news and photographs around the world almost instantly. Telemetry is the process of gathering physical data by radio.

Radio technology is also essential to space exploration. Space probes use radio waves to relay information about the solar system. Revealing pictures of Jupiter, Saturn, Uranus, and Neptune were obtained by radio signals from the Voyager space probes. Even without spacecraft, radio has helped us understand our universe. Radio astronomy is used to detect celestial objects too distant and dim to be seen by optical telescopes. It can also be used to determine the chemical makeup of stars and gas clouds and the speed and direction of moving stars. Using radio astronomy, quasars were discovered in the early 1960s. Pulsars, believed to be rapidly rotating neutron stars, were discovered later in the decade. With the information about the outer reaches of the universe that radio astronomy yields, scientists can piece together the puzzle of how the universe began.

(adopted from «electronics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. What do the proper names and numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Guglielmo Marconi received the first transatlantic video signals in St. John's in December 1901.
2. The wireless signals were sent from a transmitter in England.
3. Radio was used primarily to exchange messages with ships at sea.
4. Telephone communication is carried only by electrical signals.
5. Low-frequency radio signals are called microwaves.
6. Land-based microwave relay stations transmit the microwave signals.
7. Radio astronomy is used to detect celestial objects too distant and dim to be seen by optical telescopes.

Exercise 4. Answer the following questions.

1. Where did Guglielmo Marconi receive the first transatlantic radio signal?
2. Where were the wireless signals sent from?
3. What was radio primarily used for?
4. How do cellular mobile telephones work?
5. What is telemetry?
6. What do space probes use radio waves for?
7. When were quasars discovered?

Exercise 5. Match the word with its definition.

1. radio	a. the sending or receiving of signals using electromagnetic waves without a connecting wire
2. wireless	b. any of the very distant starlike heavenly objects that give off very strong blue and ultraviolet light and powerful radio waves
3. coaxial	c. relating to radio communications
4. cable	d. the limitless three-dimensional extent in which all things exist and move

5. relay	e. a bundle of electrical wires held together usually around a central core
6. satellite	f. the signal used in the sending or receiving of television images
7. video signal	g. a period of 10 years
8. quasar	h. a tubular instrument for viewing distant objects (as objects in outer space) by focusing light rays with mirrors or lenses
9. space	i. a star with the group of heavenly bodies that revolve around it ; esp: the sun with the planets, moons, asteroids, and comets that orbit it
10. solar system	j. a man-made object or vehicle intended to orbit the earth, the moon, or another heavenly body
11. telescope	
12. decade	

Part 3

The basis of electronics is the electronic signal, an electric current that represents information. There are two basic types of electrical signals: analog and digital. In analog signals, some continuously variable aspect of the electrical current represents the information. In amplitude modulated (AM) radio transmissions, for example, the amplitude, or strength, of the electromagnetic radio wave is proportional to the amplitude of the signal—the volume of the sound that the radio wave carries. The greater the amplitude of the radio wave, the louder the sound that radiates from the radio speaker.

In contrast, digital signals use standardized pulses to represent numbers. With a digital audio signal, the amplitude of the signal for a set amount of time is converted to a number represented by, for example, 16 pulses of fixed duration and amplitude. The audio signal as a whole is transmitted as a series of such 16-pulse codes.

Most electronic devices use digital signals. In these signals the numbers are almost always represented in binary code; that is, instead of using a number system based on 10, as is used in writing numbers and manual arithmetic, electronic systems use numbers based on 2. There are only two basic numbers in this system: 0 and 1, with 1 being represented by a pulse and 0 by the absence of a pulse, or some similar arrangement.

(adopted from «electronics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out the numerals.

Exercise 2. What do the numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The basis of electronics is the electronic circuit.
2. There are two basic types of electrical signals.
3. The greater the amplitude of the radio wave, the quieter the sound
4. Digital signals use standardized pulses to represent numbers.
5. The amplitude of the signal for a set amount of time is converted to a number.
6. The video signal as a whole is transmitted as a series of such 16-pulse codes.
7. Modern electronic devices use digital signals.

Exercise 4. Answer the following questions.

1. What is the basis of electronics?
2. What is the electronic signal?
3. How many basic types of electrical signals are there?
4. What is electromagnetic radio wave proportional to?
5. When is the sound that radiates from the radio speaker louder?
6. What do digital signals use?
7. How many pulse codes are there in the series which presents the audio signal?

Exercise 5. Match the word with its definition.

1. electronics	a. relating to data in the form of numerical digits
2. analog	b. the degree of loudness of a sound
3. digital	c. a system of symbols (as letters or numbers) used to represent assigned and often secret meanings
4. current	d. belonging to a system of numbers having two as its base
5. amplitude	e. one half of the up-and-down extent of the vibration of a wave
6. volume	f. electronic circuits, devices, and equipment
7. duration	g. able to change: likely to be changed
8. code	h. something that is analogous to something else
9. binary	i. a piece of equipment to serve a special purpose
10. manual	j. the time during which something exists or lasts
11. device	
12. variable	

Unit 3. Scientific Methods Used in Physics

Part 1

Physics attempts to describe and explain the physical universe. Physicists therefore try to discover one or more laws (meaning invariable principles of nature at work) that will explain a large class of phenomena. Newton's law of gravitation is a fine example. Another is the law of reflection—«the angle of reflection is equal to the angle of incidence.»

Physicists express these laws in mathematical form, which can serve later as a basis for measurements and calculations. For example, Newton's law of gravitation states that the force of gravitational attraction (*F*) between two separate objects depends on the amount of mass (*m*) of each one and the distance (R) between them. The masses must be multiplied together, and the pull diminishes according to the square of the distance. If the distance is doubled, for example, the pull is only one fourth as great. The whole law can be stated in a short formula:

$F = Gm_1m_2/R_2$, where *G* is the universal gravitational constant.

This formula can be used in turn to give answers to a host of problems. Newton used it to help explain Kepler's laws. Later it was used to find the masses of other planets, stars, and galaxies. Today it is also used (with some corrections courtesy of Albert Einstein) to plan the trajectories of spacecraft.

Whenever possible, physicists try to discover laws and test them by experiments in which the variables involved can be controlled or measured accurately. For example, Michael Faraday discovered the laws of electrolysis by measuring how much material was transported by known amounts of electric current in an electrolytic cell. Robert A. Millikan determined the fundamental unit of electricity, the charge carried by one electron, by making thousands of measurements upon microscopic droplets of oil that were kept dancing in a vacuum between oppositely charged metal plates.

(adopted from «physics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names.

Exercise 2. What do the proper names from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Physics attempts to describe and explain the physical universe.
2. Physicists try to discover some laws that will explain a large class of phenomena.
3. Newton's law of gravitation is a fine example.
4. The angle of incidence is equal to the angle of reflection.»
5. The masses must be multiplied together, and the pull diminishes according to the square of the distance.

6. The formula $F = Gm_1m_2/R_2$ can be used in turn to give answers to a host of problems.
7. Michael Faraday discovered the law of gravitation.

Exercise 4. Answer the following questions.

1. Who tries to describe and explain the physical universe?
2. How many laws to explain phenomena do physicists try to discover?
3. Who discovered the law of gravitation?
4. What is the law of reflection?
5. What does Newton's law of gravitation state?
6. What was the use of Newton's law of gravitation?
7. What did Robert A. Millikan determine?

Exercise 5. Match the word with its definition.

1. physics	a. a force acting between particles of matter, tending to draw them together, and resisting their separation
2. law	b. to become gradually less
3. measurement	c. the producing of chemical changes by passage of an electric current through an electrolyte
4. attraction	d. a science that deals with matter and energy and their actions upon each other in the fields of mechanics, heat, light, electricity, sound, and the atomic nucleus
5. diminish	e. the act or process of measuring
6. distance	f. a rule or principle stating something that always works in the same way under the same conditions
7. galaxy	g. one of the very large groups of stars and other matter that are found throughout the universe
8. trajectory	h. able to be seen only through a microscope : very small
9. electrolysis	i. a general fact or rule expressed in symbols and especially mathematical symbols
10. microscopic	j. the curve that a body (as a planet in its orbit or a rocket) travels along in space
11. cell	
12. formula	

Part 2

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) Direct tests were impossible, because no human being could hope to approach close enough to a star to get a sample for chemical analysis.

b) Often when physicists cannot make a direct experiment, they can solve problems indirectly.
c) An example is the way physicists learned the chemical composition of the sun and other stars.
d) About a century ago, however, a way was found around this difficulty.

Exercise 2. Put the words and phrases of the given sentences into the proper order.

1) physicists / For a long time / from a glowing substance / that light / had known / can be separated / called the spectrum / into bands of colored lights / such as the matter in the sun.
2) In the case of sunlight / many fine dark lines / this spectrum / is crossed by / Fraunhofer absorption lines / called.
3) In 1859 Gustav Kirchhoff and Robert Bunsen / these dark lines / by bright ones / could be matched exactly / heating chemical elements / to glowing in a laboratory / produced by / found that.
4) show exactly / are in the sun / Thus the lines / which chemical elements.
5) In fact / was found first / by its spectral lines / and only later / the element helium / in the sun / identified on Earth.

Exercise 2. Fill in the gaps with the words from the box.

boiling decay element gravity helium hydrogen react spectroscope universe

Helium is a colorless, odorless, gaseous 1___________. It is chemically inert; hence it will not burn or 2___________ with other materials. Helium has the lowest boiling point of any element. Next to hydrogen, it is the lightest known gas and the second most abundant element in the 3___________. It is found in great abundance in the stars, where it is synthesized by nuclear fusion of 4____________. In the Earth's atmosphere, helium is present only in about 1 part per 186,000 because the Earth's 5____________ is not strong enough to prevent its gradual escape into space. The helium present in the Earth's atmosphere has been generated by the radioactive 6____________ of heavy substances. This technique, called spectroscopy, made it possible to learn the chemical composition of a star by using a 6____________ attached to a telescope. Modern refinements also indicate a star's temperature and the speed and direction of its motion.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word or phrase with its definition.

1. experiment	a. an examination of a whole to discover its elements and their relations
2. chemical	b. the group of different colors including red, orange, yellow, green, blue, indigo, and violet arranged in the order of their wavelengths and seen when white light passes through a prism and falls on a surface or when sunlight is scattered by water droplets to form a rainbow
3. approach	c. light such as that given off by something that is very hot but not flaming
4. analysis	d. the absence of the quality of something that stimulates the sense of smell
5. substance	e. an instrument that produces spectra from or by the use of electromagnetic waves
6. spectrum	f. acting or operated or produced by chemicals
7. heating	g. a procedure or operation carried out under controlled conditions in order to discover something, to test a hypothesis, or to serve as an example
8. glowing	h. the union of light atomic nuclei to form heavier nuclei resulting in the release of enormous quantities of energy
9. odorless	i. unable or slow to move, act, or react
10. inert	j. physical material from which something is made
11. nuclear fusion	
12. spectroscope	

(adopted from «physics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 3

Many ancient cultures demonstrated curiosity about the world around them and, through patient observation, found patterns in nature that could be used to make certain kinds of predictions. However, without the tools and methods of physics, ancient scientists had difficulty finding explanations for such patterns and were often content with the practical results they had obtained.

Scientists began making progress almost two thousand years later, in Galileo's time, by attacking specific problems that could be tested with well-defined methods. They let the formulation of more-general theories wait until enough phenomena had been described in sufficient detail to warrant an explanation.

During the two centuries after Galileo's time, tremendous progress was made. By the early 1800s, physicists had won considerable basic knowledge about the interactions of specific forms of energy, such as heat or gravitational attraction, and matter. Even then, however, each type of interaction had to be studied separately. More than a century passed before anybody could begin to gather the interactions together into a general theory of the physical universe.

A survey of physics can be made best by proceeding as the physicists did, considering first the separate, specific types of interaction between matter and energy. The most basic topic in the study of physics is mechanics, because it establishes fundamental measurements that enter into all interactions. Different units are needed for measuring various forms of energy such as light and electricity. However, physicists keep these units consistent with those used in mechanics, thus helping to hold all the branches of physics together as one body of knowledge.

(adopted from «physics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

prediction	matter	radiowave	energy	nucleon

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Ancient scientists could explain lots of phenomena.
2. Scientists began making progress almost two thousand years later, in Galileo's time.
3. During the four centuries after Galileo's time, tremendous progress was made.
4. At the beginning of the 19th century physicists had won considerable basic knowledge about the interactions of specific forms of energy.
5. A century later scientists began to gather the interactions together into a general theory of the physical universe.
6. The most basic topic in the study of physics is mechanics.
7. Light and heat are needed for measuring various forms of energy.

Exercise 4. Answer the following questions.

1. Why did ancient scientists have difficulties in finding explanations?
2. When did scientists begin making progress?
3. Why did scientists begin making progress in Galileo's time?
4. What were the results of scientists' work at the beginning of the 19th century?
5. When did scientists begin to gather the interactions together into a general theory of the physical universe?
6. What is the basic topic in the study of physics?
7. What does mechanics establish?

Exercise 5. Match the word with its definition.

1. observation	a. pleased and satisfied with what one has or is
2. pattern	b. to put in systematic form : state definitely and clearly
3. content	c. electric current
4. obtain	d. to guarantee something to be as it appears or is represented to be
5. formulation	e. the action or influence of people, groups, or things on one another
6. warrant	f. the material substance that occupies space, has mass, and makes up the observable universe
7. interaction	g. the act or an instance of surveying or of applying the principles and methods of surveying
8. matter	h. a science that deals with energy and forces and their effect on bodies
9. survey	i. to gain or acquire usually by planning or effort
10. separate	j. an act of gathering information (as for scientific studies) by noting facts or occurrences
11. mechanics	
12. electricity	

Unit 4. Light

Part 1

Unlike many other animals, humans depend primarily on sight to learn about the world around them. During the day early peoples could see by the light that came from the sun; but night brought darkness and danger. One of the most important steps people have taken to control their environment occurred when they learned to conquer the dark by controlling fire—a source of light.

Torches, candles, and oil lamps are all sources of light. They depend on a chemical reaction—burning—to release the energy we see as light. Plants and animals that glow in the dark—glowworms, fireflies, and some mushrooms—change the chemical energy stored in their tissues to light energy. Such creatures are called bioluminescent. Electric-light bulbs and neon lights change electrical energy, which may be produced by chemical, mechanical, or atomic energy, into light energy.

Light sources are necessary for vision. An object can be seen only if light travels from the object to an eye that can sense it. When the object is itself a light source, it is called luminous. Electric lights are luminous. The sun is a luminous object because it is a source of light. An object that is not itself a source of light must be illuminated by a luminous object before it can be seen. The moon is illuminated by the sun. It is visible only where the sun's rays hit it and bounce off toward Earth—or to an observer in a spacecraft.

In a completely dark room, nothing is visible. When a flashlight is turned on, its bulb and objects in its beam become visible. If a bright overhead bulb is switched on, its light can bounce off the walls, ceiling, floor, and furniture, making them and other objects in its path visible.

(adopted from «light.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

matter	light	radiowave	source	energy

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Early peoples could see by the light that came from the sun
2. People conquered the dark by controlling fire.
3. Oil lamps are all sources of electricity.
4. Plants and animals that glow in the dark change the chemical energy stored in their tissues to light energy.
5. Electric-light bulbs and neon lights change electrical energy into atomic energy.
6. We can see the object only if light travels from the object to an eye that can sense it.
7. The sun is a bioluminescent object.

Exercise 4. Answer the following questions.

1. Why couldn't early people see objects during night?
2. What was one of the most important steps people have taken?
3. What were the first sources of light?
4. Why do some plants and animals glow in the dark?
5. How are such creatures called?
6. What are light sources necessary for?
7. Why people can't see anything in a dark room?

Exercise 5. Match the word with its definition.

1. control	a. something that makes vision possible
2. light	b. to produce by the action of fire or heat
3. burning	c. a collection of nearly parallel rays (as X-rays) or a stream of particles (as electrons)
4. tissue	d. a rounded object or part shaped more or less like a bulb
5. bulb	e. one of the lines of light that appear to be given off by a bright object
6. neon	f. to have power over
7. atomic energy	g. a mass or layer of cells usually of one kind together with the uniting or enclosing substance around and between them that form the basic structural materials of a plant or an animal
8. luminous	h. to remove from a place by force
9. visible	i. giving off light
10. ray	j. capable of being seen
11. beam	
12. bounce	

Part 2

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) The object appears to bend at the interface of the air and water.
b) Those that have convex, or bulging, surfaces bring light rays closer together.
c) Light travels in a straight line as it passes through a transparent substance.
d) This bending is called refraction.
e) But when it moves from one transparent material to another of different density—for example, from air to water or from glass to air—it bends at the interface (where the two surfaces meet).
f) The amount, or degree, of refraction is related to the difference between the speeds of light in the two materials of different densities—the greater the difference in densities, the more the speed changes, and the greater the bend.
g) A slanting object partly out of water displays refraction.
h) Lenses refract light.
i) Those that have concave, or hollowed-out, surfaces spread light rays apart.

Exercise 2. Put the words and phrases of the given sentences into the proper order.

1) that a second prism / could not add / In 1672 Isaac Newton showed / placed in the path / of a beam of one color / more color to the beam.
2) spread the beam / It did / farther apart / however.
3) the first prism / Newton / broke white light down / concluded that / by spreading them apart / into its separate parts.

4) He was able to establish / a pure color but a combination / that white light is not / in the spectrum / of all the colors.

Exercise 3. Fill in the gaps with the words from the box.

color dispersion enters prism spectrum speed red violet white

A prism spreads 1__________ light into the 2__________ because each color has a slightly different 3__________ within the prism, so each color bends (refracts) a slightly different amount as it 4__________ and again as it leaves the 5___________. 6___________ light slows up the most, so it is bent the most; 7___________ light slows up the least, so it is bent the least. This spreading apart of white light into a spectrum is called dispersion.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word or phrase with its definition.

1. refraction	a. to form an opinion : decide by reasoning
2. dispersion	b. a clear curved piece of material (as glass) used to bend rays of light to form an image especially to correct vision or magnify an object
3. transparent	c. hollowed or rounded inward like the inside of a bowl
4. density	d. not mixed with anything else : free from everything that might make dirty, change, or lower the quality
5. lens	e. the separation of light (as by a prism) into a series of colors
6. concave	f. a reddish blue
7. convex	g. curved or rounded like the outside of a sphere or circle
8. prism	h. the bending of a ray when it passes at an angle from one medium into another in which its speed is different
9. pure	i. a transparent object that usually has three sides and bends light so that it breaks up into rainbow colors
10. violet	j. transmitting light so that objects lying beyond are entirely visible
11. conclude	
12. spectrum	

(adopted from «light.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 3

By the 17th century enough was known about the behavior of light for two conflicting theories of its structure to emerge. One theory held that a

light ray was made up of a stream of tiny particles. The other regarded light as a wave. Both of these views have been incorporated into the modern theory of light.

Newton thought that light was composed of tiny particles given off by light sources. He believed that the different colors into which white light could be broken up were formed by particles of different sizes. He thought refraction resulted from the stronger attraction of the denser of two substances for the particles of light. Since the attraction was greater, the speed of light in denser mediums should also be greater, according to his theory. A basic piece of evidence supporting the particle view of light is that light travels in straight lines. This can be seen when a small, steady light source shines on a relatively large object. The shadow of the object has sharp borders. Newton felt that if light were a wave, it would curve slightly around obstacles, giving fuzzy-edged shadows. He pointed out that water waves curve as they pass an obstacle (for example, dock pilings) and that sound waves curve over hills and around the corners of buildings. Newton realized, however, that simple variations in the size of particles did not explain all light phenomena. When he tried to understand the shimmering coloration of soap bubbles, he had to introduce the idea that the particles vibrated.

Christian Huygens, a Dutch physicist, proposed that light was a wave. He postulated that a substance called the ether (not to be confused with the class of chemicals called ethers) filled the universe. Waves were generated in this substance when light traveled through it. Huygens assumed that light waves were like sound waves—the movement of alternately compressed and rarefied ether. Such waves are called longitudinal waves because the vibration of the wave is parallel to the direction in which it is traveling.

(adopted from «light.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

particle light signal fluctuation wave

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. By the 17th century nothing was known about the behavior of light.
2. The first theory held that a light ray was made up of a stream of tiny particles.
3. The first theory became the modern theory of light.
4. Newton thought that light was composed of tiny particles given off by light sources.
5. Newton felt that if light were a wave, it would curve slightly around obstacles.
6. Simple variations in the size of particles explained all light phenomena.
7. Waves were generated in the ether when light traveled through it.

Exercise 4. Answer the following questions.

1. What were the first two theories of light?
2. Who thought that light was composed of tiny particles given off by light sources?
3. Why did Newton think that light was composed of particles?
4. Where was Christian Huygens from?
5. What did he postulate?
6. Which theory of light did Christian Huygens support?
7. How did both theories influence the modern theory of light?

Exercise 5. Match the word with its definition.

1. structure	a. a substance through which a force acts or by which something is carried
2. stream	b. the dark figure cast on a surface by a body that is between the surface and the light
3. attraction	c. having a higher mass per unit volume
4. denser	d. an invisible substance once believed to fill the upper regions of space
5. medium	e. something constructed or arranged in a definite pattern of organization
6. steady	f. a force acting between particles of matter, tending to draw them together, and resisting their separation
7. shadow	g. something that bends or turns without angles
8. curve	h. relating to length
9. vibrate	i. to make or become rare, thin, or less dense
10. ether	j. a state or condition of a system or process that does not change or changes only slightly over time
11. rarefied	
12. longitudinal	

Unit 5. Matter

Part 1

Most of the matter that people ordinarily observe can be classified into one of three states, or phases: solid, liquid, or gaseous. Solid matter generally possesses and retains a definite size and shape, no matter where it is situated. A liquid, unlike a solid, assumes the shape of its container, even though, like a

solid, it has a definite size, or volume. A gas expands to fill the complete volume of its container.

At a given temperature and pressure, a substance will be in the solid, liquid, or gaseous state. But if the temperature or the pressure changes, its state may also change. At constant atmospheric pressure the state of water, for example, changes with changes in temperature. Ice is water in the solid state. If it is removed from a freezer and placed in a warm pan, the ice warms up and changes to the liquid—water. If the pan is then placed over a hot fire, the water heats up and changes to the gaseous state of water—steam.

Most substances can exist in any of the three states (provided that they do not decompose chemically, as sugar, for example, often does when it is heated in air). Oxygen must be cooled to very low temperatures before it becomes a liquid or a solid. Quartz must be heated to very high temperatures before it becomes a liquid or a gas.

In most people's experience, wide changes in pressure are not as common as drastic changes in temperature. For this reason, examples of the effects of pressure on the states of matter are not common. Often, high-pressure machines and vacuum (low-pressure) machines must be used to study the effects of pressure changes on matter. Under very low pressures, matter generally tends to enter the gaseous phase. At very high pressures gases tend to liquefy and liquids tend to solidify. In fact, at the very lowest temperatures that can be reached, helium will not solidify unless a pressure of some 25 times normal atmospheric pressure is applied.

The relation between pressure and temperature in changes of state is familiar to people who live at high altitudes. There the pressure is lower than at sea level, so water boils at a lower temperature. Cooking anything in water takes longer on a mountaintop than at sea level.

These properties of the three states of matter are easily observed. They are explained, however, by a theory that describes the behavior of particles far too small to be seen.

(adopted from «matter.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

particle	pressure	signal	matter	solid

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The matter can be classified into one of two states.
2. A liquid assumes the shape of its container.
3. A gas expands to fill the complete volume of its container.
4. If the temperature or the pressure changes, its state may remains the same.

5. The state of water changes with changes in temperature.
6. The gaseous state of water is steam.
7. Under very low pressures, matter generally tends to enter the solid phase.

Exercise 4. Answer the following questions.
1. What are the three states of matter?
2. How do temperature and pressure change the state of matter?
3. What happens with water if we change temperature?
4. Why are the examples of the effects of pressure on the states of matter not common?
5. What happens with matter under very low pressures?
6. How can we feel the relation between pressure and temperature?
7. Where are the properties of the three states of matter explained?

Exercise 5. Match the word with its definition.

1.	state	a.	remaining steady and unchanged
2.	liquid	b.	the degree of hotness or coldness of something (as air, water, or the body) as shown by a thermometer
3.	volume	c.	a special quality of something
4.	pressure	d.	a condition or stage of the physical makeup of something
5.	constant	e.	an amount of space as measured in cubic units
6.	steam	f.	the invisible vapor into which water is changed when heated to the boiling point
7.	oxygen	g.	the vertical distance of an object above a given level (as sea level)
8.	temperature	h.	the force exerted as a result of the weight of the atmosphere
9.	altitude	i.	a physically different portion or kind of matter present in a mixed system
10.	property	.	j a reactive element that is found in water, rocks, and free as a colorless tasteless odorless gas which forms about 21 percent of the atmosphere, that is capable of combining with almost all elements, and that is necessary for life see element table
11.	particle		
12.	phase		

Part 2

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) Such material is called a plasma.
b) At extremely high temperatures atoms may collide with such force that electrons are knocked free from the nuclei.
c) The resulting mixture of free negative and positive particles is not a gas according to the usual definition.
d) Actually, about 99 percent of the known matter in the universe is in the plasma state.
e) Some scientists consider the plasma state to be a fourth state of matter.

Exercise 2. Put the words and phrases of the given sentences into the proper order.
1) for the electrons / matter is hot enough / In stars / and in interstellar space / to be completely separated / from the nuclei / it is diffuse enough.
2) somewhat unusual conditions / From an astronomical standpoint / where plasmas / exist on Earth / are difficult to produce.
3) matter in forms / other than the four states / may contain / The universe.
4) Dying stars / into conditions / are thought to collapse / to be reproduced / far too dense / on Earth.
5) for example / the equivalent of the mass / White dwarf stars / may contain / packed into the volume of the Earth / of the entire sun.

Exercise 3. Fill in the gaps with the words from the box.

black equal escape existence matter neutron pulsars radiation sphere

Pulsars are believed to be rapidly spinning 1__________ stars. In a neutron star a mass 2__________ to that of the sun would be compressed within a 3__________ less than 20 miles (32 kilometers) in diameter. In the most extreme case, 4___________ becomes so dense that its gravitational attraction pulls in all matter and radiation within a certain critical distance. Since no light can 5___________ from such a collapsed star, it is called a 6___________ hole. In 1994, the Hubble Space Telescope found the first conclusive evidence for the 7___________ of a black hole, at the center of galaxy M87, 50 million light-years from Earth.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word with its definition.

1.	atom	a.	a collection of charged particles that shows some characteristics of a gas but that differs from a gas in being a good conductor of electricity and in being affected by a magnetic field
2.	collide	b.	the process of giving off radiant energy in the form of waves or particles

3. electron	c.	the smallest particle of an element that has the properties of the element and can exist either alone or in combination
4. mixture	d.	two or more substances that are mixed together but not chemically combined and that may vary in proportion
5. plasma	e.	to come together with solid impact
6. interstellar	f.	poured or spread out : not concentrated
7. diffuse	g.	an elementary particle that has a negative charge of electricity and travels around the nucleus of an atom
8. collapse	h.	a globe-shaped body
9. star	i.	a straight line passing through the center of a figure or body
10. sphere	j.	located or taking place among the stars
11. diameter		
12. radiation		

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Part 3

The theory of relativity, which considers matter and energy equivalent, greatly extended scientists' understanding of matter. This theory states that anything having energy has mass and that the amount of mass is related to the amount of energy. The exact relationship is given by Albert Einstein's famous equation, E=mc2. In this equation, E is the total relativistic energy of a body, m is its relativistic mass, and c is the speed of light in free space (186,300 miles per second, or 3×108 meters per second). Relativistic mass, like ordinary mass, is attracted by gravitational fields.

Scientists had been accustomed to viewing matter and energy as two separate quantities of the universe. But the theory of relativity combines the two. It states that an object's relativistic mass varies as its speed, or kinetic energy, changes. An object traveling at a high velocity will have a greater relativistic mass than the same object traveling at a low velocity. The smallest mass a body can have is the mass it has when it is at rest. This minimum mass is called the body's rest mass.

Even at speeds which are ordinarily regarded as quite high—the speed of a jet aircraft, for example—the increase in mass from the rest mass is too small to detect. But in high-energy accelerators, when a particle travels at speeds near the speed of light, the relativistic mass of the particle increases observably.

(adopted from «matter.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

velocity	relativity	hologram	mass	current

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The theory of chaos, which considers matter and energy equivalent, greatly extended scientists' understanding of matter.
2. The speed of light in free space is 186,300 miles per second.
3. Relativistic mass, like ordinary mass, is attracted by electromagnetic fields.
4. The theory of relativity states that an object's relativistic mass varies as its speed changes.
5. C is the speed of light in free space.
6. The largest mass a body can have is the mass it has when it is at rest.
7. This minimum mass is called the body's rest mass.

Exercise 4. Answer the following questions.

1. What was the use of the theory of relativity?
2. Who gave the famous equation E=mc2?
3. What do the letters E, m, c in the equation E=mc2 denote?
4. What is the speed of light in free space?
5. Which object has a greater relativistic mass?
6. How is the minimum mass called?
7. What are the changes of the mass of a particle in high-energy accelerators?

Exercise 5. Match the word and phrase with its definition.

1. theory of relativity	a.	the capacity (as of heat, light, or running water) for doing work
2. extend	b.	an expression involving chemical symbols for a chemical reaction
3. state	c.	the whole body of things observed or assumed
4. energy	d.	relating to the whole of something
5. equation	e.	a theory in physics that considers mass and energy to be equal and that states that a moving object will experience changes in mass, size, and time which are related to its speed and are not noticeable except at speeds approaching that of light
6. total	f.	quickness of motion
7. universe	g.	to stretch out or reach across a distance, space, or time
8. combine	h.	to discover the nature, existence, presence

9. velocity — i. a device that is used to give high velocities to charged particles (as electrons and protons)
10. increase — j. to make or become greater
11. detect
12. accelerator

Unit 6. Astronomy

Part 1

The apparent westward motion of the sun, the moon, and the stars is not real. They seem to move around Earth, but it is actually Earth that moves. It is rotating eastward, completing one rotation each day. This is hard to believe at first because when we think of motion we also think of the vibrations of moving cars or trains. But Earth moves freely in space, without rubbing against anything, so it does not vibrate. It is this gentle rotation, uninhibited by significant friction, that makes the sun, the moon, and the stars appear to be rising and setting.

Earth is accompanied by the moon, which moves around the planet at a distance of about 30 Earth diameters. At the same time, Earth is moving around the sun. Every year Earth completes one revolution around the sun. This motion, along with the tilt of Earth's axis, accounts for the changes in the seasons. When the northern half of Earth is tipped toward the sun, then the Northern Hemisphere experiences summer and the Southern Hemisphere, which is tipped away from the sun, experiences winter. When Earth has moved to the other side of the sun, six months later, the seasons are reversed because the Southern Hemisphere is then tipped toward the sun and the Northern Hemisphere is tipped away from the sun.

If you watch the moon for three or four weeks, you will see that it does not always look the same. Sometimes it looks like a big disk, sometimes like a tiny curved sliver. These changes are called the phases of the moon. They occur because the moon shines only when the sun's light bounces off its surface. This means that only the side of the moon that faces the sun is bright. When the moon is between Earth and the sun, the light side of the moon faces away from Earth. This is called the new moon, which is not visible. When the moon is on the other side of Earth from the sun, its entire light side faces Earth. This is called the full moon. Halfway between the new and full moons, in locations on either side of Earth, are the first quarter and the last quarter.

(adopted from «astronomy.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

motion	bifurcation	moon	wave	Earth

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Earth moves freely in space.
2. Earth is rotating westward, completing one rotation each day.
3. Earth is accompanied by the moon, which moves around the planet.
4. Earth is moving around the sun.
5. Every year Earth completes two revolutions around the sun.
6. The moon does not always look the same.
7. The sun shines only when the moon's light bounces off its surface.

Exercise 4. Answer the following questions.

1. Which objects are rotating around the sun?
2. How often can we see the full moon?
3. What is the distance between Earth and the moon?
4. When do we have summer?
5. When does the moon shine?
6. What is the phase of the moon?
7. Why is the moon different?

Exercise 5. Match the word with its definition.

1. motion — a. the action of vibrating
2. rotation — b. the action by a heavenly body of going round in an orbit
3. vibration — c. a straight line about which a body or a geometric figure rotates or may be supposed to rotate
4. friction — d. the act of rotating especially on an axis
5. accompany — e. a thin circular object
6. revolution — f. the rubbing of one thing against another
7. axis — g. capable of being seen
8. disk — h. to occur at the same time as or along with
9. bounce — i. a place fit for or having some particular use
10. visible — j. a unit (as of weight or length) that equals one fourth of some larger unit
11. location
12. quarter

Part 2

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) Such a display is called a meteor shower and occurs when the Earth passes through a swarm of meteoroids.
b) On a clear, dark night an observer may see ten or more meteors per hour.
c) Because of their small size, these meteors generally burn up in the upper atmosphere and never reach the ground.
d) As the Earth travels in its orbit around the sun, it continually encounters meteoroids head-on.
e) Sometimes an unusually large number of small meteors can be seen in rapid succession—perhaps more than 50 per hour.

Exercise 2. Put the words and phrases of the given sentences into the proper order.

1) through the orbit of a comet / Some meteor showers / and coincide / occur regularly / each year / with the passage of the Earth.
2) a trail of debris / moves in its orbit / it leaves / As a comet.
3) This debris / tiny pieces of grit and ice / from the tail of the comet / may be / or it may be / that has disintegrated / fragmentary remains of a comet.
4) may actually be / this cometary debris / Some astronomers / that cause meteor showers / suggest that / that the tiny meteoroids.
5) —the meteors that do reach the ground— / On the other hand / meteorites / similar to asteroids / have a composition / resemble asteroidal orbits / and their orbits.

Exercise 3. Fill in the gaps with the words from the box.

asteroids debris destroyed lunar meteorites meteors moon origin radar

Furthermore, regularities in their compositions suggest that they may have a common 1___________from one or no more than a few bodies. Thus many astronomers believe that 2___________ originated from the disintegration of one or more 3___________ Current evidence indicates that a small number of meteorites may have come from the moon and from Mars. Scientists have suggested that at least three meteorites may be 4___________ resulting from the impact of some large body on the 5___________ surface. It has also been suggested that several meteorites may be the result of a similar impact on the Martian surface. Humankind's understanding of 6___________ and meteorites is still far from complete, but each year the methods for collecting information are improved. When a meteorite falls to Earth, trained observers collect as much evidence as possible before it can be moved or destroyed. Sometimes they are able to examine the evidence in a laboratory within 24 hours after the impact. Researchers may also use 7___________ to track meteors as they travel through the skies.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word with its definition.

1. orbit	a. a repeated following of one person or thing after another
2. meteoroid	b. the remains of something broken down or destroyed
3. observer	c. a meteor that reaches the surface of the earth
4. succession	d. one of the small bodies of matter in the solar system observable when it falls into the earth's atmosphere where the heat of friction may cause it to glow brightly for a short time
5. meteor	e. a meteor revolving around the sun
6. comet	f. the path taken by one body circling around another body
7. debris	g. a small hard sharp particle (as of sand)
8. grit	h. relating to, or resembling the moon
9. meteorite	i. one of thousands of small planets between Mars and Jupiter with diameters from a fraction of a kilometer to nearly 800 kilometers
10. asteroid	j. a bright heavenly body that develops a cloudy tail as it moves closer to the sun in its orbit
11. lunar	
12. radar	

(adopted from «astronomy.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 3

Comets are the most unusual and unpredictable objects in the solar system. They vary in appearance from small stellar images, like small asteroids, to huge tailed objects so bright that they can be seen in daytime near the sun. Comets are small bodies composed mostly of ices of various substances—principally water and gases—with some silicate grit mixed in. This composition and the nature of the comets' orbits suggest that comets were formed before or about the same time as was the rest of the solar system.

Comets can be divided into two groups: short-period comets, whose orbits of the sun take less than 200 years, and long-period comets, with periods on the order of millions of years. Short-period comets are members of the inner solar system. When farthest away from the sun, long-period comets can be halfway to the nearest stars. Comets can hit Earth; for example, the Tunguska explosion that occurred in 1908 in central Siberia is thought to have resulted from such a collision.

Hundreds of millions of comets may exist in a large cloud, called the Oort cloud that is believed to surround the solar system. Occasionally comets may leave the Oort cloud when the cloud is perturbed—perhaps by the gravitational force of a passing star. These comets enter the inner solar system and orbit the sun in long elliptical paths. Occasionally one of these intruders may be gravitationally influenced by the larger planets and pulled into a closer, shorter orbit, with a period of about seven years. Most comets, however, have much longer periods. Halley's Comet takes about 76 years to complete an orbit, and many comets may take thousands or even millions of years.

As a comet approaches the sun, some of its ices evaporate. The solar wind pushes these evaporated gases away from the head of the comet and away from the sun. This gives the comet a long glowing tail that always points away from the sun.

(adopted from «astronomy.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. What do the proper names and numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Comet is the most unpredictable object in the solar system.
2. Comets are large bodies composed mostly of ices of various substances.
3. Comets were formed before or about the same time as was the rest of the solar system.
4. We divide comets into five groups.
5. Short-period comets are members of the inner solar system.
6. Hundreds of millions of comets may exist in a large cloud, called the Oort cloud.
7. Halley's Comet takes about 67 years to complete an orbit.

Exercise 4. Answer the following questions.

1. What is a comet?
2. Why can comets be seen in a daytime?
3. When were comets formed?
4. What does the comet's tail consist of?
5. Why do some comets leave the Oort cloud?
6. What happened in central Siberia in 1908?
7. How long does it take to complete the orbit?

Exercise 5. Match the word with its definition.

1. appearance	a. the way someone or something looks
2. stellar	b. a chemical salt that consists of a metal combined with silicon and oxygen
3. substance	c. the act or an instance of exploding
4. silicate	d. having the shape of an ellipse
5. inner	e. relating to the stars
6. explosion	f. to disturb greatly
7. surround	g. situated farther in
8. perturb	h. to pass off or cause to pass off into vapor from a liquid state
9. elliptical	i. to enclose on all sides
10. period	j. physical material from which something is made
11. evaporate	
12. glowing	

Unit 7. Mechanics

Part 1

Scientists consider both forces and velocities as vectors. Vectors are shown by arrows: they represent quantities that have both a specific magnitude—size or strength—and direction. Velocity, for example, has both magnitude and direction. Although the words speed and velocity are used interchangeably, speed is properly only the magnitude of the velocity vector. A complete description of an object's velocity requires both knowledge of the object's speed and the direction in which it is traveling. For example, a stone whirled in a circle at the end of a string has a changing velocity even if it moves at a fixed number of revolutions per minute. The stone's speed is constant, but its direction of travel, and therefore its velocity, changes continuously. The force on the stone that causes the change in velocity is another vector, called a centripetal force. Its magnitude is the tension in the string, and its direction is radially inward toward the center of the circle described by the spinning stone.

Two forces applied simultaneously to the same point have the same effect as a single equivalent force. The magnitude and direction of this resultant force can be found by drawing the two original force vectors head to tail and then drawing a new vector—the resultant force vector—from the tail of the first vector to the head of the second. Similarly, vectors can also be added by the use of parallelograms.

The same forces can have different effects depending on how they are applied and on the specific body to which they are applied. For example, if applied in a certain way, a force may cause a body to spin, or rotate. The tendency of a force to rotate the body to which it is applied is called torque, or moment of the force. Torque is also a vector. The magnitude of the torque can be calculated by multiplying the perpendicular distance between the line of the force and the axis of rotation.

(adopted from «mechanics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key words are mentioned in it.

forces	energy	direction	matter	vector

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Velocity has both magnitude and direction.
2. Vectors are shown by parallel lines.
3. The stone's speed is constant, but its direction of travel, and therefore its velocity, changes continuously.
4. Speed is properly only the magnitude of the velocity vector.
5. The force on the stone that causes the change in velocity is another vector, called a centrifugal force.
6. Two forces applied simultaneously to the same point have the same effect as a single equivalent force.
7. The magnitude of the torque can be calculated by summing the perpendicular distance between the line of the force and the axis of rotation.

Exercise 4. Answer the following questions.

1. How are vectors shown?
2. What do the arrows denote?
3. What does velocity have?
4. What is required to describe an object's velocity?
5. How is the force that causes the change in velocity called?
6. How can we find the magnitude and direction?
7. What is torque?

Exercise 5. Match the word with its definition.

1. vector	a. a number representing the brightness of a star
2. magnitude	b. the line or course along which something moves, lies, or points
3. size	c. alike or equal in number, value, or meaning
4. description	d. a quantity that has magnitude and direction and that is usually represented by a line segment with the given direction and with a length representing the magnitude
5. direction	e. to use in finding a product by multiplication
6. changing	f. the measurements of a thing
7. inward	g. an account of something
8. simultaneously	h. coming from or resulting from something else
9. equivalent	i. existing or occurring at the same time
10. resultant	j. situated on the inside
11. torque	
12. multiplying	

Part 2

Exercise 1. Put the sentences into the proper order and read the whole paragraph.

a) These principles are known as Newton's laws.
b) Therefore, particles (or even worlds) of matter will keep flying through empty space forever, without being driven by any force, until something compels them to change their motion.
c) Classical mechanics is governed by three basic principles, which were first formulated in the 17th and 18th centuries by Isaac Newton.
d) The first law describes a fundamental property of matter, called inertia, as follows:
e) Under this law a moving body is at rest, as far as its own inertia is concerned, as long as its motion continues at the same speed and in the same direction.
f) Every body remains in a state of rest or in a state of uniform motion (constant speed in a straight line) unless it is compelled by impressed forces to change that state.

Exercise 2 Put the words and phrases of the given sentences into the proper order.

1) Newton's second law / a force compels a change of motion / called acceleration / at a rate of change / in which / describes the manner.
2) stated as follows: / It can be.
3) is proportional to / Change of motion / and takes place in the direction of / to the impressed force / that force is impressed / the straight line in which.
4) in a different manner / This law is often stated / is equal / to the product of the body's mass / times the resulting acceleration / the net force acting on a body.

5) using letters for force / and acceleration: / mass / F = ma / It can be stated / as a formula / much more simply.

Exercise 3. Fill in the gaps with the words from the box.

bootstraps	calculations	equal	jet	law	law
opposite	reaction	third			

Newton's 1___________ law may be stated as follows: Action and 2___________ are 3___________ and opposite. This law is often expressed as «for every action there is an equal and opposite reaction.» The law states a fact that can upset many 4___________ unless it is taken into account. It explains, for example, the saying that a man cannot literally 5___________ himself by his own bootstraps. As he pulls up on his bootstraps, the 6__________ pull down on him. Action and reaction are equal and 7__________. A striking modern example of action and reaction is jet propulsion.

Exercise 4. Look through the paragraphs above and give the title to the whole text.

Exercise 5. Match the word with its definition.

1. mechanics	a. of central importance
2. principle	b. the action or process of propelling
3. fundamental	c. the rate of change of velocity with respect to time
4. inertia	d. a property of matter by which it remains at rest or in unchanging motion unless acted on by some external force
5. motion	e. a general or basic truth on which other truths or theories can be based
6. compel	f. an act or process of changing place or position
7. empty	g. a general fact or rule expressed in symbols and especially mathematical symbols
8. acceleration	h. containing nothing
9. impressed force	i. to cause to do something by the use of physical, moral, or mental pressure
10. formula	j. chemical transformation or change : the action between atoms or molecules to form one or more new substances
11. reaction	
12. propulsion	

(adopted from «mechanics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 3

When a force makes a body move, the product of the force times the distance through which the force acts is called the work done by the force. Although the word work has many common meanings, physicists always use it in its restricted sense.

The capacity to do work is called energy, and if work is done on a body, the energy of the body increases. For example, if the work goes into increasing the body's speed, the body in turn has the ability to do work by virtue of its motion. Energy associated with motion is called kinetic energy. The kinetic energy (KE) of a body is equal to one half the product of its mass times the square of its velocity (KE=1/2 mv2). Energy may take many forms in addition to the kinetic kind, however, and energy can be converted from one form to another. Another common form of energy is illustrated by a tensioned device such as a bow or spring. Though at rest, the bow or spring has the potential for creating motion; it contains potential energy because of its configuration.

An example of the relationship between work and energy is the lifting of an object. When a body is lifted, work is performed against the gravitational force of the Earth. The body's potential energy increases relative to its initial level, and it has the capacity to do more work than it could before. For example, to raise a mass of 1 kilogram (2.2 pounds of weight) from ground level to a height of 10 meters (32.8 feet) requires a force of 9.81 newtons (2.2 pounds). (This value can be calculated from Newton's second law, F=ma.) Since the mass of the object is 1 kilogram and the Earth's gravitational acceleration is 9.81 meters/second2 (32.2 feet/second2), the downward force exerted by gravity is 1×9.81=9.81 newtons (2.2 pounds). To counteract this downward force it is necessary to exert a force of the same magnitude—9.81 newtons (2.2 pounds)—upward. The work done in raising the mass, and therefore the increase in the object's potential energy, is thus the force times the height, 9.81×10 or 98.1 newton-meters (2.2x32.8=72.16 foot-pounds). If the body is now allowed to fall back to its original level, the potential energy will be converted into kinetic energy

(adopted from «mechanics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and copy out proper names and numerals.

Exercise 2. What do the proper names and numerals from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The capacity to do work is called energy.
2. Energy associated with motion is called kinetic energy.
3. When a body is lifted, its potential energy decreases.

4. The kinetic energy (KE) of a body is equal to one half the product of its mass times its velocity (KE=1/2 mv).
5. Energy may take many forms.
6. When a body is lifted, its potential energy doesn't change.
7. The potential energy can be converted into kinetic energy.

Exercise 4. Answer the following questions.

1. How can we define the work done by the force?
2. When does the energy increase?
3. What is kinetic energy?
4. How do we count the kinetic energy?
5. What energy can the kinetic energy be converted into?
6. How can we illustrate the energy?
7. What happens with a lifted body?

Exercise 5. Match the word with its definition.

1. restricted	a. the ability to hold or contain
2. capacity	b. to put forth (as strength)
3. kinetic energy	c. the work required to move a single positive charge from a reference point (as at infinity) to a point in question
4. velocity	d. energy associated with motion
5. device	e. to move to a higher position, rate, or amount
6. convert	f. to change from one substance, form, use, or unit to another
7. potential	g. relating to or being the origin or beginning
8. lifting	h. a numerical quantity that is assigned or is found by calculation or measurement
9. gravitational force	i. a force of attraction that tends to draw particles or bodies together
10. value	j. being or placed under limits or restrictions
11. exert	
12. original	

9. READING ROOM FOR STUDENTS OF CHEMISTRY

Unit 1. Organic and Inorganic Chemistry

Part 1

Exercise 1. Fill in the gaps with the words from the box. Read the whole paragraph.

similarity	properties	to form	characteristic	react	organic	ethyl

Just as a family of elements in the periodic table has similar (1) …, so does a family of (2) … compounds.

This (3) …arises from the properties of some characteristic group in each family.

In the examples shown, the (4) … group is attached to the group called methyl (CH_3) in the alcohol, ketone, amine, and amide; with a hydrogen atom (H) in the aldehyde and acid.

The (5) … groups (C_2H_5) are in the ether and ester.

The characteristic group can (6) … with the characteristic group of other compounds 7. …new compounds.

Exercise 2. Put the sentences into the proper order. Read the whole paragraph.

a. Moreover, these families can be considered to be derivatives of the hydrocarbon methane (CH_4).
b. The chemist has organized the study of compounds of carbon in much the same way he has organized the study of the elements; that is, by grouping them into families.
c. He finds that all organic compounds can be grouped into a small number of families.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

a. has learned / the properties / The organic chemist / how to use / new compounds / of each / in making / characteristic group.

b. a given compound / he can make / Hence/ derivatives / of / many new.
c. a formula / He can / design / then / corresponds to / that / the compound / make / that formula.

Exercise 4. Look through the paragraphs above and put them into proper order. Give the title to the whole text.

Exercise 5. Match the word and phrase with its definition.

1. to group	a. to make a pattern or sketch of formula
2. the study of compounds of carbon	b. an easily evaporated flammable liquid used chiefly to dissolve other substances and especially formerly as an anesthetic
3. a derivative	c. to go through or cause to go through a chemical reaction
4. similar properties	d. properties having qualities in common
5. organic compounds	e. to arrange or combine in a group
6. aldehyde	f. a compound that usually dissolves in water, has a sour taste, reacts with a base to form a salt, and turns litmus paper red
7. acid	g. a substance that can be made from another substance in one or more steps
8. ether	h. aldehyde
9. ester	i. an organic compound formed by the reaction between an acid and an alcohol
10. to react	j. to be equivalent (as in meaning, position, purpose, or structure)
11. to design a formula	
12. to correspond	

(adopted from «organic chemistry.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2
Carbon compounds

Carbon unites with many elements to form a great variety of compounds that are found in such substances as coal, petroleum, fabrics, plastics, and

rubber. Other carbon compounds include plant and animal tissues, sugars, proteins, starches, and cellulose. About 1 million carbon compounds are known. The substances that contain carbon are called organic compounds, and the science that deals with them is known as organic chemistry.

This name arose because chemists once thought that many of these compounds could be formed only by a vital force (a life process). This was disproved in 1828 when the German chemist Friedrich Wöhler converted the compound ammonium cyanate, NH4CNO, into urea (NH2)2CO.

Before this, urea had been known only as a product of life processes. Today chemists can make many of the products that formerly had been produced only by living plants and animals.

Carbon compounds exist in such number and variety because of the chemical properties of carbon. Carbon has four valence electrons that form covalent bonds. Since carbon is in Group IV of the periodic table, it appears to be midway between the metals and nonmetals and has the ability to react with both types of elements. The structure of the carbon atom is unique among atoms, allowing a great array of compounds that are stable under normal atmospheric conditions and reactive in other situations. Carbon reacts as follows:

1. Carbon atoms have the unusual property of combining with each other to form rings or long chains. No other element does so as extensively.

2. Carbon will combine with many different atoms or groups of atoms. This property, together with the ability to form long chains, makes carbon the most versatile of all elements in forming compounds.

3. Carbon forms many compounds that exist as isomers. Isomers are molecules with the same number and kinds of atoms, but in different arrangements—for example, CH3CHCl2 and CH2ClCH2Cl.

(adopted from «organic chemistry.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following keywords are mentioned. Put them in the order they appear in the text.

carbon	include	examples	organic	ethyl	properties	valence

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Carbon unites with many elements to form a great variety of compounds.
2. There is no known carbon compound.
3. The substances that contain carbon are called inorganic compounds.
4. Many of organic compounds could be formed only by a vital force.
5. Carbon has seven valence electrons that form covalent bonds.
6. Carbon has the ability to react with metals and nonmetals.
7. Carbon ions have the unusual property of combining with each other to form rings or long chains.

Exercise 4. Answer the following questions.

1. Does carbon unite with many elements to form a great variety of compounds that are found in such substances as coal, petroleum, fabrics, plastics, and rubber?
2. What substances are called organic compounds?
3. What was discovered in 1828?
4. Why does carbon compound exist in such number and variety?
5. Carbon has four valence electrons that form covalent bonds, hasn't it?
6. What is the chemical ability of carbon?
7. How does carbon react?

Exercise 5. Match the word and phrase with its definition.

1. carbon	a. an oily flammable liquid that may vary from almost colorless to black, is obtained from wells drilled in the ground, and is the source of gasoline, kerosene, fuel oils, and other products
2. coal	b. a plastic substance ; any of numerous synthetic or processed materials that can be formed into objects, films, or fibers
3. plastic	c. a soluble nitrogen-containing compound that is the chief solid substance in the urine of mammals and is an end product of protein breakdown
4. fabric	d. a black or brownish black solid substance that is formed by the partial decay of vegetable matter under the influence of moisture and often increased pressure and temperature within the earth and that is widely used as a fuel
5. petroleum	e. a nonmetallic element found more or less pure in nature (as in diamond and graphite) or as a part of coal and petroleum and of the bodies of living things or obtained artificially see element table
6. starch	f. to change from one substance, form, use, or unit to another
7. urea	g. a white odorless tasteless carbohydrate that is the chief form in which carbohydrate is stored in plants, is an important food, and is used also in adhesives, in laundering, and in pharmacy and medicine
8. to convert into	h. product relating to living existence
9. a product of life process	i. means by which atoms, ions, or groups of atoms are held together in a molecule or crystal
10. a valence electron	j. property of mixing together so that the identity of each part is lost
11. a covalent bond	
12. a property of combining	

Part 3

Inorganic Chemistry

The modern idea of the nature of a chemical compound—a single substance containing fixed proportions of two or more elements—was adopted early in the 19th century. The number of known compounds then was growing fast as chemists learned to separate and analyze the substances found in nature. To organize and simplify the facts concerning these compounds, they classified those obtained from living organisms—plants and animals—as organic and all others as inorganic. This seemed especially logical as long as no one knew how to convert any compound of either class into any compound of the other. Many scientists believed that the formation of organic compounds required the action of some unidentified vital force that could be exerted only by living things.

In 1828 the German chemist Friedrich Wohler made the organic compound urea by heating the inorganic compound ammonium cyanate. He thereby proved that no vital force is needed, but the idea continued to affect the thinking of some chemists for many years. By the time the concept was abandoned, the division of chemical compounds into organic and inorganic had become permanent. All of the organic compounds contain carbon, but very few of the inorganic ones do, so the definition of organic compounds was changed to conform to this fact: Any compound of carbon is an organic compound except carbon monoxide, carbon dioxide, carbonates, cyanides, cyanates, thiocyanates, and certain carbides.

Once the definition of inorganic compounds has been decided, inorganic chemistry can be defined as the study of these compounds and of the elements from which they are formed. It is a search for the answers to three different kinds of questions—descriptive, theoretical, and technological.

Descriptive. The description of a substance provides information about its physical and chemical properties.

Theoretical. The objective of theoretical inorganic chemistry is the discovery of general laws and principles that can account for the properties and reactions of substances.

Technological. Inorganic chemical technology is the application of theory and experience to the industrial production of practical compounds. It is closely related to economics and engineering.

(adopted from «inorganic chemistry.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key-words are mentioned. Put them in the order they appear in the text.

organic	concept	compound	inorganic	example	carbon

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. A chemical compound is a single substance containing fixed proportions of two or more elements.
2. Many scientists believed that the formation of organic compounds required the action of some unidentified vital force that could be exerted only by living things.
3. In 1828 the German chemist Friedrich Wohler made the organic compound urea by cooling the inorganic compound ammonium cyanate.
4. All of the organic compounds contain hydrogen.
5. The description of a substance provides information about its physical and chemical properties.
6. The objective of theoretical inorganic chemistry is the discovery of hypothesizes.
7. The Periodic Law, was proposed in 1869 by the American chemist Glenn Seaborg.
8. Inorganic chemical technology is the application of theory and experience to the industrial production of practical compounds.

Exercise 4. Answer the following questions.

1. What is the modern idea of the nature of a chemical compound?
2. What was the reason for growing the number of known compounds?
3. Many scientists believed that the formation of organic compounds required the action of some unidentified vital force that could be exerted only by living things, didn't they?
4. What did the German chemist Friedrich Wohler make in 1828?
5. Do all of the organic compounds contain carbon or hydrogen?
6. Is any compound of carbon an organic compound?
7. What are three different kinds of questions?

Exercise 5. Match the word and phrase with its definition.

1. to convert the compound	a. the use to which theory is put
2. inorganic compound	b. not special law
3. urea	c. lasting or intended to last for a very long time : not temporary or changing lasting
4. to heat	d. inorganic chemical method of doing something technologically
5. permanent	e. a soluble nitrogen-containing compound that is the chief solid substance in the urine of mammals and is an end product of protein breakdown
6. principle	f. pressure of atmosphere
7. under ordinary conditions	g. under regular or usual condition
8. atmospheric pressure	h. a general or basic truth on which other truths or theories can be based
9. general law	i. made up of two or more parts that are alike and form a common inorganic whole
10. descriptive	j. to make or become warm or hot
11. the application of theory	
12. inorganic chemical technology	

Unit 2. Carrying out the Experiment

Part 1

Exercise 1. Fill in the gaps with the words from the box. Read the whole paragraph and paragraphs above in this Exercise.

seen	hottest	to burn	hydrogen	brightest	substance	flame	invisible

The (1) … flames are not always the (2) … .

(3) …, which combines with oxygen when burning to form water, has an almost (4) … flame even under ordinary circumstances.

When it is absolutely pure and the air around it is completely free of dust, the hydrogen (5) … cannot be (6) …even in a dark room.

Whenever a flammable gas is mixed with air in exactly the quantities necessary for complete combination, it will burn so fast as to create an explosion. This is what takes place in a gasoline engine. The carburetor provides the air mixture, and the electric spark sets it on fire.

The small explosions that sometimes occur after the burners of a gas stove are turned off are from the gas remaining in the pipe. Air creeps in through the air valve until the mixture becomes explosive, and the tiny flame that remains on the burner fires back.

Exercise 2. Put the sentences into the proper order. Read the whole paragraph.

a. When a coal fire flames, it does so because gas is being forced from the coal, and the carbon and hydrogen in the gas combine with oxygen.
b. The flames come from the combination of this gas with oxygen in the air.

c. If kept from burning, such gas can be stored.
d. Manufactured gas is forced from coal in airtight kilns, or retorts.
e. Fire may burn either with or without flames.
f. A flame always indicates that heat has forced gas from a burning substance.
g. Coke will burn without flame because no gas is driven off.
h. In order to burn, the carbon in the coke combines directly with oxygen.
i. The product left after the gas is extracted from coal is called coke.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. the heated wax/ the bright flame/ that produces/ It is the gas/ by/ in a candle/ given off.
2. is blown out/ a burning candle/ When/ a thin ribbon/ for example/ will arise/ of smoke.
3. through this smoke/ If a lighted/ is passed/match/ an inch (2.5 centimeters) /a tiny flame/ above the wick/ relight the candle/and/ will run down.

Exercise 4. Look through the paragraphs above and put them into proper order. Give the title to the whole text.

Exercise 5. Match the word and phrase with its definition.

1. burning substance	a. a gasoline machine that changes energy (as heat from burning fuel) into mechanical motion
2. combination of the gas with oxygen	b. airtight oven or furnace for hardening, burning, or drying something
3. airtight kiln	c. a result or product of combining of the gas with oxygen
4. to extract	d. to get out by pressing, distilling, or by a chemical process
5. coke	e. the part of an engine in which fuel (as gasoline) is mixed with air to make it burn easily
6. completely free of dust	f. completely free of fine dry powdery particles
7. to create an explosion	g. the act or process or an instance of mixing of
8. a gasoline engine	h. substance that is or set on fire
9. a carburetor	i. gray lumps of fuel with pores made by heating soft coal in a closed chamber until some of its gases have passed off
10. an air mixture	j. to create the act or an instance of exploding
11. an electric spark	
12. an air valve	

(adopted from «fire.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2
Fire

When cavemen learned to make and use fire, they could start to live in civilized ways. With fire, they were able to cook their food so that it was easier to eat and tasted better. By the light of torches, men could more easily find their way at night. They could also improve their wooden tools by hardening the points in fire. With fire to keep them warm, they could live in the colder regions and spread out over the Earth.

It is supposed that early people got fire accidentally from trees set ablaze by lightning or from spouting volcanoes. Then they carefully kept it burning in huts or caves. As far back as the study has gone, primitive peoples have never been found without fire for warmth and cooking. Fire also protected them from wild beasts.

In time people discovered how to create fire by rubbing dry sticks together. Then they invented bow drills to aid the process. When they began to chip flint to make axes, they found that hot sparks came from the stone. From this they later developed the flint-and-steel method of fire making. Later it was found that fire could be made by focusing the sun's rays with a lens or curved mirror.

People remained ignorant of the true character of fire until 1783. In that year the great French chemist Antoine Lavoisier investigated the properties of oxygen and laid the foundation for modern chemistry.

Lavoisier showed that ordinary fire is due to the chemical process called oxidation, which is the combination of a substance with oxygen. He disproved the earlier «phlogiston» theory. The phlogiston theory held that when an object was heated or cooled it was due to a mysterious substance (phlogiston) that flowed into or out of the object in question.

Since fires are due to oxidation, they need air to burn properly, and a flame will go out after it has used up the oxygen in a closed vessel. Almost anything will combine with oxygen if enough time is allowed. Iron will rust if exposed long to damp air, and the rust is simply oxidized iron. When the chemical combination is so rapid that it is accompanied by a flame, it is called combustion.

(adopted from «fire.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key-words are mentioned. Put them in the order they appear in the text.

discovered fire chlorine oxidation oxygen water protected

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. When cavemen learned to make and use fire, they could start to live in civilized ways.
2. It is supposed that early people had matches to get fire.
3. In time people discovered how to create fire by rubbing dry sticks together.
4. People remained ignorant of the true character of fire until 1783.
5. French chemist Antoine Lavoisier investigated the properties of helium and laid the foundation for modern chemistry.
6. Since fires are due to oxidation, they need air to burn properly, and a flame will go out after it has used up the oxygen in a closed vessel.
7. Iron will not rust if exposed long to damp air.

Exercise 4. Answer the following questions.

1. When could cavemen start to live in civilized ways?
2. How did early people get fire?
3. How did fire help early people in their life?
4. What were the ways of creating fire in early times?
5. Who investigated the properties of oxygen and laid the foundation for modern chemistry in 1783?
6. What did Lavoisier prove?
7. What is combustion?

Exercise 5. Match the word and phrase with its definition.

1. to investigate	a. to make or become cool
2. property of oxygen	b. to make or become warm or hot
3. modern chemistry	c. a result or product of combining of substance
4. chemical process	d. chemical result or product of combining
5. oxidation	e. an act or instance of burning сжигание
6. combination of a substance	f. modern science that deals with the composition, structure, and properties of substances and with the changes that they go through
7. to heat	g. property of reactive element that is found in water, rocks, and free as a colorless tasteless odorless gas which forms about 21 percent of the atmosphere, that is capable of combining with almost all elements, and that is necessary for life
8. to cool	h. to study by close examination and systematic inquiry
9. chemical combination	i. a chemical continuing action or series of actions or changes
10. to rust	j. to occur at the same time as or along with
11. combustion	
12. to accompany	

Part 3

Ignition point, or Kindling temperature

Heat is required to start combustion. The degree of temperature at which a substance will catch fire and continue to burn is called its ignition point or its kindling point. A substance that can be ignited in the air is said to be flammable (or inflammable). The flash point of a flammable liquid is lower than its ignition point. The flash point is the temperature at which it gives off sufficient vapor to flash, or flame suddenly, in the air. It is not the temperature at which the substance will continue to burn.

When primitive peoples rubbed two sticks together to kindle a fire, they discovered without knowing it that the ignition point of wood is usually quite high. They had to use enough energy to create a good deal of heat before flames appeared. The tip of a match is composed of chemicals that, under ordinary circumstances, have a low ignition point. The heat created by scratching it once on a rough surface is enough to start combustion.

It must be remembered, however, that the temperature needed to sustain combustion can vary with the condition of the substance and the pressure of the air or other gases involved, as well as with laboratory test methods.

Cause of Spontaneous Combustion

The ignition points of some vegetable and animal oils are low. They oxidize so quickly that they generate a great deal of heat. If kept in a confined place, they may burst into flame. Fires may be caused by the spontaneous combustion of heaps of rags, paper, and similar materials that are soaked with oil. Coal and charcoal stored in large piles sometimes generate enough heat to set themselves on fire. Certain bacteria in moist hay may cause the temperature of the hay to rise rapidly and start a fire.

A form of spontaneous combustion, hypergolic ignition, is used to fire a liquid-fuel rocket. Two liquids are pumped into the rocket combustion chamber: a chemical oxidizer and a fuel with which it reacts. On contact they rise to ignition temperature. Through oxidation they burst into flame. Burning at a high temperature, the pressure they create provides the jet thrust that propels the rocket.

(adopted from «fire.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key-words are mentioned. Put them in the order they appear in the text.

heat ignition star flammable moon combustion flames

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Heat is required to start combustion.
2. The flash point of a flammable liquid is higher than its ignition point.
3. When primitive peoples rubbed two sticks together to kindle a fire, they discovered without knowing it that the ignition point of wood is usually quite high.
4. Primitive peoples had to use enough matches before flames appeared.
5. The heat created by scratching it once on a rough surface is not enough to start combustion.
6. The ignition points of some vegetable and animal oils are low.
7. Certain bacteria in moist hay may cause the temperature of the hay to rise rapidly and start a fire.

Exercise 4. Answer the following questions.

1. What are the names of degree of temperature at which a substance will catch fire and continue to burn?
2. What is a flammable substance?
3. Is the ignition point of a wood usually quite high?
4. What is the tip of a match composed of?
5. How can we cause combustion?
6. How can be fire caused?
7. What is used to fire a liquid-fuel rocket?

Exercise 5. Match the word and phrase with its definition.

1. ignition point	a. an act or instance of burning
2. kindling temperature	b. temperature of setting on fire or taking fire
3. combustion	c. point of acting of igniting
4. chemical	d. oxidizer relating to chemical
5. condition	e. a dark or black absorbent carbon made by heating animal or vegetable material
6. pressure	f. any of numerous greasy flammable usually liquid substances from plant, animal, that do not dissolve in water
7. laboratory test method	g. a way, plan, or procedure for laboratory test
8. vegetable and animal oil	h. the action of a force against an opposing
9. oxidize	i. a substance (as an element or compound) obtained from a chemical process or used to get a chemical result
10. charcoal	j. a state of being
11. a chemical oxidizer	
12. at a high temperature	

Unit 3. Systematization of Chemical Elements

Part 1

Exercise 1. Fill in the gaps with the words from the box. Read the whole paragraph.

recurrence ,period, recur, conclusion, elements, change, periodic

Mendeleyev noticed that the elements do not (1) …properties gradually, in keeping with gradual increase in atomic weights.

Rather, the properties change gradually through a certain number of elements, called a «(2) ….» The properties and their pattern of changes (3) …, or repeat, through the next period.

To express this (4) …, Mendeleyev stated the .

The properties of the (5) … law are periodic functions of the atomic weights.

The German chemist, Julius Lothar Meyer, independently reached a similar (6) ….

Exercise 2. Put the sentences into the proper order. Read the whole paragraph.

1. Chemists now know that the periodic law is better expressed in terms of atomic number than in terms of atomic weight, and Mendeleyev's original table has been rearranged to reflect that idea.
2. Today the lighter elements can be arranged in a table according to their properties.
3. When the elements are arranged according to the law, the result is the periodic table of the elements.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. at the atomic weights / their chemical properties / By looking / and /of the elements / chemists discovered / follow a pattern / that / that the elements / lets them / in a very useful way / be organized.

2. the Russian chemist / in 1869 / The first person / was/ Dmitri Mendeleyev / to describe / successfully / this pattern.
3. All the elements / have / of the table / in each /vertical column / chemical properties / similar.
4. forms a group (for example, group IIA) /of these related / A column /elements. Each horizontal row forms a period of elements.

Exercise 4. Look through the paragraphs above and put them into proper order. Give the title to the whole text.

Exercise 5. Match the word and phrase with its definition.

1. atomic weights	a. increasing by slight degree
2. to form groups and periods	b. to express something occurs or appears again
3. to follow a pattern	c. to give back an image or likeness of as if by a mirror
4. to change properties gradually	d. to reach a similar final decision
5. gradual increase	e. the average atomic mass of an element compared to 1/12 the mass of the most abundant kind of carbon
6. to express the recurrence	f. to arrange in order of groups and periods
7. periodic function	g. chemical properties that have qualities in common
8. to reach a similar conclusion	h. to change properties by slight degree
9. in terms of	i. to put in a particular order in a table according to
10. to reflect	j. with respect to or in relation to
11. to arrange in a table according to	
12. similar chemical properties	

(adooted from»chemical element.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007)

Part 2
Atomic Properties

Chemical elements are classified or identified according to properties of their atoms. Atoms are composed of three fundamental particles: the proton, the neutron, and the electron. Each of these plays a role in defining the element.

Atomic Number.The heart of each atom, its nucleus, contains one or more protons, each having a positive electric charge. The number of protons and

thus the number of positive charges varies from one in hydrogen, the lightest element, to 92 in uranium, the heaviest of the naturally occurring elements. This number is known as the atomic number. The atomic number was devised by the English scientist Henry Moseley in 1913. He arranged the elements according to the patterns they produced when struck by X rays. Later on, his arrangement was shown to coincide with the number of positive charges—protons—in the nucleus.

Atomic Weight.Atoms are very light in weight. One oxygen atom weighs only 0.000000000000000000000027 gram (the metric system of measurement is the one used universally in science). The resulting number is known as the gram-atomic weight.

The nucleus of an atom is surrounded by negatively charged electrons. The electrons are arranged in layers or shells. An atom can have as many as seven shells, each of which holds only a certain number of electrons. The lightest element, hydrogen, has one electron in the first shell. The heaviest elements in their normal states have only the first four shells fully occupied with electrons and the next three shells partially occupied.

Usually only the outermost shell is shown, since this is the shell that is involved in chemical activity. If the outermost shell is complete, or filled with the maximum number of electrons for that shell, the atom is electrically stable and inert, with little or no tendency to interact with other atoms. Helium, with two electrons filling its single shell, and neon, with two electrons in its first shell and eight in its second, are both inert.

Atoms with incomplete outer shells seek to fill or to empty such shells by gaining or losing electrons or by sharing electrons with other atoms. This is the basis of an atom’s chemical activity. Atoms that have the same number of electrons in the outer shell have similar chemical properties, since their methods of attaining complete outer shells or eliminating incomplete ones are similar.

(adopted from»chemical element.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following keywords are mentioned. Put them in the order they appear in the text.

weight atom shell ester number gram liquid

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?
1. Chemical elements are classified or identified according to properties of their atoms.
2. Atoms are composed of two fundamental particles: the proton, the neutron.
3. The heart of each atom, its nucleus, contains one or more protons, each having a positive electric charge.
4. Atoms are very heavy in weight.
5. Atomic weights can not be expressed in grams.

6. The nucleus of an atom is surrounded by negatively charged electrons.
7. The lightest element, hydrogen, has two electrons in the first shell.

Exercise 4. Answer the following questions.

1. How are chemical elements classified or identified?
2. What is the composition of atom?
3. What is atomic number?
4. Who devised the atomic number in 1913?
5. What is atomic weight?
6. What is the surrounding of nucleus of an atom?
7. What is the basis of an atom's chemical activity?

Exercise 5. Match the word and phrase with its definition.

1. to compose	a. to occupy the same place in space or time
2. particle	b. the central part of an atom that includes nearly all of the atomic mass and consists of protons and usually neutrons
3. nucleus	c. an electromagnetic radiation of an extremely short wavelength that is able to penetrate various thicknesses of solids and to act on photographic film as light does
4. thus	d. one of the very small parts of matter (as a molecule, atom, or electron)
5. naturally occurring element	e. unable or slow to move, act, or react
6. X ray	f. because of this or that
7. to coincide	g. to form by putting together
8. metric	h. farthest out shell
9. negatively or positively charged	i. an active force
10. outermost shell	j. of, relating to, or based on the metric system
11. inert	
12. activity	

Part 3

Classification of Elements in the Periodic Table

The periodic table provides an easy way to identify related groups of elements. Those elements on the left of the periodic table are base-forming, while those on the right are acid-forming. Those in between can be either. They form

so-called amphoteric oxides and hydroxides that can act like acids or bases. The periodic arrangement also divides the elements into metallic and nonmetallic kinds. A distinction is usually made between pure metals and nonmetals according to physical and chemical properties. Of the elements shown in the table above, lithium (Li), beryllium (Be), sodium (Na), magnesium (Mg), aluminum (Al), potassium (K), and calcium (Ca) are metallic. The others are nonmetallic.

The periodic table groups elements into chemical families. For example, Group 0 contains helium (He), neon (Ne), and argon (Ar). These are included in the family of elements called the noble gases. (In some tables, this group is labeled VIII instead of 0.) In Group IA are hydrogen (H), lithium, sodium, and potassium. Except for hydrogen, these are soft, active substances that act chemically like metals in many ways. They react with water to form basic, or alkaline, solutions. Because of these properties they are known as alkali metals. In Group IIA is the family of elements known as the alkaline earth metals. In Group VIIA are the halogens. Their compounds with hydrogen, for example hydrogen fluoride (HF) and hydrogen chloride (HCl), dissolve in water to form acids. Hydrogen is sometimes included with the halogens because of certain characteristics it shares with them.

Many elements with atomic numbers greater than 20 show complicated structures, due to inner shells of electrons that accept as many as 18 or 32 electrons. Elements having atoms of this type appear in the periodic table as a transition, or inserted, group between Groups IIA and IIIA. The electron structures of some elements, such as chromium, iron, and nickel, endow their compounds with bright colors. The transition elements include the rare-earth elements and the actinide series.

(adopted from»chemical element.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following keywords are mentioned. Put them in the order they appear in the text.

substance ice noble element periodic distinction glass

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. The periodic table provides an easy way to identify related groups of elements.
2. All elements in the periodic table are nonmetals.
3. The periodic table groups elements into chemical families.
4. Alkali metals do not react with water.
5. Halogens are not included to the periodic table.
6. Hydrogen is sometimes included with the halogens because of certain characteristics it shares with them.
7. The transition elements include the rare-earth elements and the actinide series.

Exercise 4. Answer the following questions.

1. What does periodic table provide?
2. What is the division of the chemical elements?
3. How does the periodic table group elements?
4. What elements are included in the family called the noble gases?
5. What are alkali metals?
6. What elements show complicated structure?
7. The electron structures of which elements endow the compounds with bright colors?

Exercise 5. Match the word and phrase with its definition.

1. base-forming	A. a silver-white soft light metallic element that has a low melting point and occurs abundantly in nature especially combined in minerals see element table
2. acid-forming	B. any of the metals in the group that consists of lithium, sodium, potassium, rubidium, cesium, and francium
3. rare	C. a soft waxy silver-white metallic element that is chemically very active and is common in nature in combined form see element table
4. arrangement	D. situated further
5. sodium	E. any of various metallic elements (as chromium, iron, and nickel) that can form bonds using electrons from two energy levels instead of only one
6. potassium	F. the condition of being dissolved
7. complicated structure	G. very uncommon
8. inner	H. something made by arranging
9. noble gases	I. formation of fundamental part
10. alkali metals	J. formation of a compound that usually dissolves in water, has a sour taste, reacts with a base to form a salt, and turns litmus paper red
11. solution	
12. transition elements	

Unit 4. Ecology: Ozone Layer

Part 1

Exercise 1. Fill in the gaps with the words from the box. Read the whole paragraph.

pollutants environment wastes regard catches

Ecology shows that people can not (1) …nature as separate and detached—something to look at on a visit to a forest preserve or a drive through the country.

Any changes made in the (2) …affect all the organisms in it.

When vehicles and factories hurl (3) …into the air, animals and plants as well as humans themselves are harmed.

The water they foul with (4) …and silt threatens remote streams and lakes.

Even ocean fisheries may experience reduced (5) …because of pollution.

Exercise 2. Put the sentences into the proper order. Read the whole paragraph.

1. Ecologists investigate the interactions of organisms in various kinds of environments.
2. The word ecology was coined in 1869.
3. It comes from the Greek oikos, which means «household.»
4. The science that deals with the ways in which plants and animals depend upon one another and upon the physical settings in which they live is called ecology.
5. In this way they learn how nature establishes orderly patterns among a great variety of living things.
6. Economics is derived from the same word.
7. However, economics deals with human «housekeeping,» while ecology concerns the «housekeeping» of nature.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

of every form/ Ecology emphasizes/ of life/ the dependence/ on other living things/ in its environment/ and /such as air / on the natural resources/ soil and water.

the great English biologist/ a science of ecology/ Charles Darwin/ Before there was/ this interdependence/ noted/ when he wrote:

«It is interesting to contemplate a tangled bank, clothed with plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and so dependent upon each other in so complex a manner, have all been produced by laws acting around us.»

Exercise 4. Look through the paragraphs above and put them into proper order. Give the title to the whole text.

Exercise 5. Match the word and phrase with its definition.

1. physical setting	a. to view or consider with careful and thoughtful attention созерцать
2. interactions of organisms	b. to depend on one another взаимозависимость
3. environment	c. a usable natural stock or supply природные ресурсы
4. emphasize the dependence	d. physical manner, position, or direction in which something is set
5. natural resources	e. the whole complex of factors (as soil, climate, and living things) that influence the form and the ability to survive of a plant or animal or ecological community окружающая среда
6. interdependence	f. the action or influence of organisms on one another взаимодействие организмов
7. elaborately	g. to think of : look upon относиться как
8. to contemplate	h. to place emphasis on dependence подчеркнуть зависимость
9. to regard as smth	i. made or done with great care or with much detail. тщательно сконструированные формы
10. to hurl pollutant	j. to make or become foul or filthy засорять отходами
11. to foul	
12. to experience reduced catches	

(adopted from»ecology.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Ultraviolet radiation

Often called black light, ultraviolet radiation is invisible to the human eye, but when it falls on certain surfaces, it causes them to fluoresce, or emit visible light. That portion of the electromagnetic spectrum adjacent to the short wavelength, or violet, end of the visible light range, is called ultraviolet radiation.

Ordinary light is a mixture of light of many different colors. A beam of sunlight passing through a prism fans out into a band of colors. At one end of this band is

red, followed by orange, yellow, green, blue, and violet, each color blending into the next. This particular sequence is called the visible range of the electromagnetic spectrum because it is the only range of the spectrum that humans can see with the unaided eye. Visible light itself is only a small part of a much larger spectrum of electromagnetic radiation. Electromagnetic radiation also includes ultraviolet light as well as gamma rays, X rays, infrared radiation, radio waves, and microwaves.

Ultraviolet radiation is emitted from some high-temperature surfaces, such as the sun. The ultraviolet spectrum is usually divided into two regions: near, or soft, ultraviolet (nearer the visible spectrum), with wavelengths of 2,000 to 3,800 angstroms (200 to 380 nanometers); and far, or hard, ultraviolet, with wavelengths of 100 to 2,000 angstroms (10 to 200 nanometers).

Recently, however, because of certain emissions from factories on Earth and other sources, the ozone layer over parts of the Earth has been rapidly thinning or completely disappearing. Although efforts are being made to stem the emissions, if ozone depletion were to continue at the present rate—which is faster than ultraviolet light can create ozone—the incidence of cancer, certain eye diseases, and other ailments could rise significantly among people in most regions of the world.

(adopted from»ultraviolet radiation.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following keywords are mentioned. Put them in the order they appear in the text.

electromagnetic	X files	radiation	spectrum	ozone	X rays	regard

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Ultraviolet radiation is invisible to the human eye.
2. Ordinary light is a mixture of light of many different colors.
3. Electromagnetic radiation includes only ultraviolet light.
4. The ultraviolet spectrum is not divided into regions.
5. The energy of the ultraviolet light turns atmospheric oxygen into ozone.
6. The ozone layer over parts of the Earth has been rapidly thinning or completely disappearing.
7. Efforts are being made to stem the emissions. TRUE

Exercise 4. Answer the following questions.

1. Is ultraviolet radiation invisible to the human eye?
2. What is ordinary light?
3. What colors are at one end of the band?
4. What is the division of ultraviolet spectrum?
5. What is ozone layer?
6. What would happen if ozone depletion were to continue at the present rate?
7. What ailments could ozone depletion cause?

Exercise 5. Match the word and phrase with its definition.

1. a beam	a. n electromagnetic radiation of an extremely short wavelength that is able to penetrate various thicknesses of solids and to act on photographic film as light does
2. visible	b. to reduce in amount by using up : exhaust especially of strength or resources
3. unaided eye	c. he action or process of radiating
4. spectrum of electromagnetic radiation	d. to bring into existence создавать
5. X rays	e. a ray of light
6. radiation	f. an act or instance of emitting
7. angstroms	g. a bodily disorder
8. emissions	h. capable of being seen
9. depletion	i. rate of occurrence
10. to create	j. a unit of length used especially of wavelengths (as of light) and equal to one ten-billionth of a meter — abbreviation Å
11. incidence	
12. ailment	

Part 3
Water Pollution

Since the beginning of civilization, water has been used to carry away unwanted refuse. Rivers, streams, canals, lakes, and oceans are currently used as receptacles for every imaginable kind of pollution. Water has the capacity to break down or dissolve many materials, especially organic compounds, which decompose during prolonged contact with bacteria and enzymes. Waste materials that can eventually decompose in this way are called biodegradable. They are less of a long-term threat to the environment than are more persistent pollutants such as metals, plastics, and some chlorinated hydrocarbons. These substances remain in the water and can make it poisonous for most forms of life. Even biodegradable pollutants can damage a water supply for long periods of time. As any form of contamination accumulates, life within the water starts to suffer. Lakes are especially vulnerable to pollution because they can not clean themselves as rapidly as rivers or oceans.

A common kind of water pollution is the effect caused by heavy concentrations of nitrogen and phosphorus, which are used by plants for growth. The widespread use of agricultural fertilizers and household detergents containing these elements has added large amounts of plant nutrients to many bodies of water. In large quantities, nitrogen and phosphorus cause tiny water algae to bloom, or grow rapidly. When the algae die, oxygen is needed to decompose them. This creates an oxygen deficiency in the water, which causes the death of many aquatic animals. Plant life soon reduces the amount of open water. These events speed up the process of eutrophication, the aging and eventual drying up of a lake.

Sedimentation also pollutes water. It is the result of poor soil conservation practices. Sediment fills water-supply reservoirs and fouls power turbines and irrigation pumps. It also diminishes the amount of sunlight that can penetrate the water. In the absence of sufficient sunlight, the aquatic plants that normally furnish the water with oxygen fail to grow.

Factories sometimes turn waterways into open sewers by dumping oils, toxic chemicals, and other harmful industrial wastes into them. In mining and oil-drilling operations, corrosive acid wastes are poured into the water. In recent years, municipal waste treatment plants have been built to contend with water contamination. Some towns, however, still foul streams by pouring raw sewage into them. Septic tanks and cesspools, used where sewers are not available, may also pollute the groundwater and adjacent streams, sometimes with disease-causing organisms. Even the purified effluent from sewage plants can cause water pollution if it contains high concentrations of nitrogen and phosphorus. Farm fertilizers in some regions fill groundwater with nitrates, making the water unfit to drink. Agricultural runoff containing dangerous pesticides and the oil, grime, and chemicals used to melt ice from city streets also pollute waterways.

(adopoted from»pollution, environmental.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following keywords are mentioned. Put them in the order they appear in the text.

biodegradable	fertilizer	key	pesticide	waste	capable	pollution

Exercise 2. What do the key words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. Water has not the capacity to break down or dissolve many materials.
2. Waste materials that can eventually decompose are called biodegradable.
3. Lakes are especially vulnerable to pollution because they can not clean themselves as rapidly as rivers or oceans.
4. A common kind of water pollution is the effect caused by heavy concentrations of chlorine and fluorine, which are used by plants for growth.
5. When the algae die, hydrogen is needed to decompose them.

6. Sedimentation also pollutes water.
7. Factories sometimes turn waterways into open sewers by dumping oils, toxic chemicals, and other harmful industrial wastes into them.

Exercise 4. Answer the following questions.

1. What capacity has water?
2. What does biodegradable mean?
3. What effect can bring to a common kind of water pollution?
4. What chemical element is needed to decompose algae when it die?
5. What is the reason of the process of eutrophication, the aging and eventual drying up of a lake.
6. Does sedimentation also pollute water? In what a way?
7. Do agricultural runoff containing dangerous pesticides and the oil, grime, and chemicals used to melt ice from city streets also pollute waterways.

Exercise 5. Match the word and phrase with its definition.

1. receptacle	a. capable of being broken down especially into harmless products by the action of living things (as bacteria)
2. pollution	b. capable of being physically or emotionally wounded
3. biodegradable	c. something used to receive and contain smaller objects
4. persistent	d. a substance (as manure or a chemical) used to make soil produce larger or more plant life
5. contamination	e. any plant or plantlike organism (as a seaweed) that includes forms mostly growing in water, lacking a system of vessels for carrying fluids, and often having chlorophyll masked by brown or red coloring matter
6. vulnerable	f. the action of polluting : the state of being polluted
7. fertilizer	g. continuing, existing, or acting for a long or longer than usual time
8. algae	h. to make impure or unfit for use by adding something harmful or unpleasant
9. eutrophication	i. the action or process of depositing sediment
10. sedimentation	j. a tank in which solid sewage is broken down by bacteria
11. corrosive	
12. septic tanks	

Unit 5. Electric Properties of Materials

Part 1

Exercise 1. Fill in the gaps with the words from the box. Read the whole paragraph.

current	snow	brain	bacteria	electrical	cells

Electrical forces are also responsible for holding body (1) …together in the shape they have.

In fact, (2) …forces are fundamental in holding all matter together.

As printed words are being read, electric currents speed along nerve cells from eye to (3) ….

The effect of an electric (4) …can be seen in the flash of lightning between thundercloud and Earth as well as in the spark that can be produced when one walks on a carpet in a dry room.

Exercise 2. Put the sentences into the proper order. Read the whole paragraph.

1. So common are its uses that one cannot imagine today's world without it.
2. The development of electricity has resulted in the total transformation of civilization in most countries.
3. Telephones would not work. Streets would not be lit.
4. It brings power into homes to operate lights, kitchen appliances, television sets, radios, furnaces, computers, garage doors, and more.
5. Storefronts and factories would be dimmed.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph .

1. were made/the/ with their/ world's modern economies/industrial/ possible by electricity/ transportation/and/ communication systems.
2. Old energy forms/ imposed limitations/ and steam/ such as water/ on production/ could be produced/ limitations on where goods/ on how much/and/ could be produced.
3. such limits/has no/electricity/ even far/it/into space/can go.

Exercise 4. Look through the paragraphs above and put them into proper order. Give the title to the whole text.

Exercise 5. Match the word and phrase with its definition.

1. to impose	a. total act, process, or example of transforming or being transformed
2. good	b. electricity in the state of being developed
3. development of electricity	c. to establish or apply as a charge or penalty

4. total transformation	d. a U.S. coin worth 1/10 dollar [Middle English dime «a tenth part,» from early French dime (same meaning), derived from Latin decimus «a tenth part,» from decem «ten» related to december decimal dozen] — a dime a dozen : so plentiful or common as to be of little value
5. kitchen appliances	e. being the one who must answer or account for something
6. furnaces	f. kitchen device (as a stove, fan, or refrigerator) or piece of office equipment that runs on gas or electricity
7. to dime	h. an enclosed structure in which heat is produced (as for heating a house or melting metals)
8. responsible	i. short bright flash of electricity between two points
9. current	j. a stream of electric charge
10. thundercloud	
11. spark	

(adopted from»electricity.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

When a gas is heated by many thousands of degrees, the individual atoms collide with enough violence to knock electrons free, resulting in a collection of positively charged ions and free, negatively charged electrons. The gas is said to be ionized, and when a sizable number of the atoms become ionized, the gas is called a plasma.

A plasma can also be formed by applying other forms of energy to a gas: irradiating it with ultraviolet or X rays, for example, or bombarding it with high-speed electrons, ions, or other particles. Because the free electrons tend to recombine with the ions to once again form a neutral gas, however, a plasma can be maintained only if the energy is continuously applied.

Scientists have estimated that more than 99 percent of the matter in the universe exists in the plasma state. Plasma exists in and around the stars, including the sun, and throughout interstellar space.

Plasma is sometimes called the fourth state of matter because plasmas possess remarkable properties not found in ordinary solids, liquids, and gases. Because the free electrons are extremely mobile, for example, plasmas are excellent conductors of heat and electricity.

Plasma is unique in the way in which it interacts with itself and with electric and magnetic fields. The motions of the free electrons set up electric currents in the plasma. A magnetic field is usually associated with the plasma and interacts with these electric currents. On a small scale the magnetic field causes the individual ions and electrons to move in circles around the magnetic field. If the plasma is very hot, the circular motion of the electrons may cause them to emit radio waves. A local disturbance of the plasma causes complicated oscillations that propagate as waves through the plasma.

On a large scale the magnetic field moves with the plasma and is said to be «frozen in.» The pressure of the field and the tension along the magnetic lines of force act on the plasma, causing it to move in complicated ways.

Conversely, the turbulent motions of the plasma may churn the field, thereby stretching, tangling, and wrapping the field back on itself and reducing it to thinner and thinner ribbons of magnetic flux. This action continues until the individual ribbons are dissipated, or until the field becomes strong enough to resist the motions, creating a complicated dynamic balance between the field and the plasma.

Around a rotating star or galaxy, the plasma's convective motion systematically folds the magnetic field into loops, producing the magnetic fields observed around these bodies. The interaction of the sun's magnetic field with the motions of the plasma in and around the sun causes such spectacular phenomena as sunspots, prominences, and flares.

(adopted from»plasma and plasma physics.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following keywords are mentioned. Put them in the order they appear in the text.

Exist	unique	X files	water	gas	plasma	X rays

Exercise 2. Look through the text and give the title to it.

Exercise 3. Are the following statements true or false?

1. When a sizable number of the atoms become ionized, the gas is called a plasma.
2. A plasma can not be formed by applying other forms of energy to a gas.
3. Scientists have estimated that 50 percent of the matter in the universe exists in the plasma state.
4. Plasma exists in and around the stars, including the sun, and throughout interstellar space.
5. Plasma is sometimes called the fourth state of matter because plasmas possess remarkable properties not found in ordinary solids, liquids, and gases.
6. Plasma is ordinary in the way in which it interacts with itself and with electric and magnetic fields.
7. A local disturbance of the plasma causes complicated oscillations that propagate as waves through the plasma.

Exercise 4. Answer the following questions.
1. When is gas called a plasma?
2. How can plasma be formed?
3. What remarkable properties does the plasma have?
4. Where does plasma exist?
5. In which a way plasma is unique?
6. What will happen if the plasma is very hot?
7. What does sunspot cause?

Exercise 5. Match the word and phrase with its definition.

1. to knock	a. an electromagnetic radiation of an extremely short wavelength that is able to penetrate various thicknesses of solids and to act on photographic film as light does
2. positively charged	b. continuing without a stop
3. negatively charged electron	c. located or taking place among the stars
4. X rays	d. to bump against something
5. continuously	e. to have and hold as property
6. interstellar space	f. a substance or body that can allow electricity, heat, or sound to pass through it
7. to possess	g. a stream of electric charge
8. conductors of heat and electricity	h. the quality, state, or fact of being prominent
9. current	i. passing or going around in a circle
10. circular motion	j. difficult action or state of oscillating
11. complicated oscillations	
12. prominence	

Part 3

One of the chemical properties of metals is the tendency of metal oxides that are dissolved in water to dissociate into electrically charged ions. In solution the metallic ion has a positive electric charge. Metallic ions play a fundamental role in many life processes. Iron, for example, is central to the structure of hemoglobin, the blood component that carries oxygen from the lungs. Calcium and potassium ions are necessary for the transmission of impulses along the body's nerve cells.

The physical properties of most metals include high density, or high mass per unit volume, and high strength, or the ability to resist being distorted from their original shape. Most metals also have great plasticity: they can change their shape without breaking. Metals also have considerable elasticity. A metal spring can be stretched, for example, but when the load is removed, it contracts to its original length.

The electronic structure of metals explains many of their properties. A single metal atom consists of a nucleus, composed of protons and neutrons, and layers, or shells, of electrons surrounding the nucleus. Each shell accepts a certain number of electrons before it is filled up and a new shell begins. In metals the outermost shell of the atom is generally not filled with all the electrons it can hold. Thus when many atoms come together to form a solid metal, the electrons in the outermost shells are shared among neighboring atoms and move freely from one atom's shell to another. If some of these electrons move in one general direction, a direct electric current is said to flow through the metal.

Heat is a phenomenon involving whole atoms. In solid metals the atoms are arranged in a regular structure. When the metal is heated, the atoms vibrate, influencing their neighbors to vibrate as well. Metals are malleable and ductile because sheets of these atoms can slip gradually past one another.

(adopted from»metal and metallurgy.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following keywords are mentioned. Put them in the order they appear in the text.

structure	phenomenon	extra	charged	metal	theory	physical

Exercise 2. Look through the text and give the title to it.

Exercise 3. Are the following statements true or false?
1. One of the chemical properties of metals is the tendency of metal oxides that are dissolved in water to dissociate into electrically charged ions.
2. In solution the metallic ion has a negative electric charge.
3. Metallic ions play a fundamental role in many life processes.
4. The physical properties of most metals include only high density, or high mass per unit volume.
5. No metal can change their shape without breaking.
6. The electronic structure of metals explains many of their properties
7. In solid metals the atoms are arranged in a regular structure.

Exercise 4. Answer the following questions.
1. What role do metallic ions play in many life processes?
2. What are the physical properties of metal?
3. What does explain many of metallic properties?
4. What is the composition of a single metal atom?
5. What happen when many atoms come together to form a solid metal?
6. How are atoms arranged in solid metals?
7. What happen when the metal is heated?

Exercise 5. Match the word and phrase with its definition.

1. to dissociate	A. a liquid in which something has been dissolved
2. solution	B. the quality or state of being able to resist
3. transmission	C. to separate from association or union with another
4. ability to resist	D. the quantity of something per unit volume, unit area, or unit length
5. density	E. an act, process, or example of transmitting
6. per	F. the quality or state of being plastic; esp: capacity for being molded or changed in form or shape
7. great plasticity	G. capable of returning to original shape or size after being stretched, pressed, or squeezed together
8. considerable elasticity	H. to or for each
9. outermost shell of the atom	I. a stream of electric charge ; also: the rate of such movement
10. electric current	J. apable of being extended or shaped by beating with a hammer or by the pressure of rollers
11. regular structure	
12. malleable	

Unit 6. The Nature of Polymeric Materials

Part 1

Exercise 1. Fill in the gaps with the words from the box. Read the whole paragraph.

chain	naturally	two- step	hydrolysis	atoms	synthetically

Organic polymers may occur 1. …, silicones can only be produced 2. ….

The most common method for preparing silicones is a 3. …process: creating a carbon-silicon bond, then making the silicon-oxygen bond that forms the 4. ….

In the first step, an organic chloride vapor is made to react with hot silicon powder in the presence of a copper catalyst.

The result is a series of molecules, called organosilicochlorides, that contain carbon, silicon, and chlorine 5. ….

In the second step, the chlorine is replaced with oxygen through a process of 6. …and distillation to produce the silicone product. By adjusting the reaction conditions, scientists can control the length of the silicon-oxygen chain or connect the individual chains in various ways.

Exercise 2. Put the sentences into the proper order. Read the whole paragraph.

1. These compounds are used in thousands of products, including lubricants, water repellents, waxes and polishes, electrical insulation, and nonstick coatings.
2. Often organic, or carbon-containing, groups are attached to the sides of the silicon atoms.
3. Unlike organic polymers, which contain chains of carbon atoms in their structural backbones, a silicone's backbone is composed of an alternating chain of silicon and oxygen atoms.
4. By adjusting the length of this silicon-oxygen chain, scientists can produce silicones in the form of fluids, resins, or elastomers (rubbers).

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph .

1. silicones/ the synthetic materials/ constitute/called/ or/ a special class/ of chemical polymers/ long-chain molecules.
2. That/ silicones/ physical/have/and/ chemical properties/sometimes/ more useful/make/polymers/other/than/ these properties/ of environmental extremes/ and /they/retain/ a wide range/over.

Exercise 4. Look through the paragraphs above and put them into proper order. Give the title to the whole text.

Exercise 5. Match the word and phrase with its definition.

1. long-chain molecules	a. a special quality of something
2. property	b. something situated as far away as possible from another
3. extreme	c. something (as a grease or oil) capable of reducing friction when applied between moving parts
4. structural backbones	d. electrical the act of insulating : the state of being insulated
5. lubricant	e. serving or tending to drive away — often used in combination
6. water repellent	f. structural foundation or sturdiest part of something

7.	electrical insulation	g.	a substance in the gaseous state
8.	nonstick coatings	h.	allowing easy removal of cooked food particles
9.	two-step process	i.	to determine the amount of an insurance claim
10.	vapor	j.	he measured distance from one end to the other of the longer or longest side of an object; also: any measured distance
11.	adjusting		
12.	length		

(adopted from «silicone.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

The number of monomers in a polymer determines the polymer's so-called degree of polymerization. When the number of monomers is very large, the compound is said to have a high degree of polymerization and is called a high polymer.

There are many other ways to characterize polymers. Homopolymers are made of only one kind of monomer. Polyvinyl chloride, often called PVC, for example, is a homopolymer built up solely from vinyl chloride, a monomer with six atoms. Copolymers differ from homopolymers in that they are composed of at least two kinds of monomers. Sometimes the sequence of the monomers combined during polymerization is governed strictly by chance; the resulting molecule is known as a random copolymer. A block copolymer is characterized by uninterrupted strings of one type of monomer alternating with similar strings of a different monomer. Graft copolymers are a string of one type of monomer with attached side chains composed of another kind of monomer.

Like building blocks, monomers link in different ways to form linear, branched, or cross-linked polymers. Linear polymers result when monomers link together to form a long chain. The resin polyvinyl chloride, for example, is a linear polymer containing from 900 to 1,300 molecules of the monomer vinyl chloride, obtained by treating the monomer with a catalyst. Branched polymers form when one of the monomers in a linear chain links up with a separate monomer or with another linear chain. The result resembles a line with a few branches.

When many randomly arranged branches of molecules link together, the result is a single molecule with a three-dimensional network of chain segments, called a cross-linked, or network, polymer. This busy microstructure often results in plastic, fibrous, foamlike, or rubbery materials. By controlling the types of monomers, the degree of polymerization, and the amount of branching and cross-linking, polymer chemists are able to make polymer materials designed for specific uses.

(adopted from»polymer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007)

Exercise 1. Look through the text and define which of the following keywords are mentioned. Put them in the order they appear in the text.

to link	polymer	spot	result	monomer	ice	branch

Exercise 2 Look through the text and give the title to it.

Exercise 3. Are the following statements true or false?

1. The number of monomers in a polymer determines the polymer's so-called degree of polymerization.
2. There are no ways to characterize polymers.
3. Copolymers differ from homopolymers in color.
4. Graft copolymers are a string of one type of monomer with attached side chains composed of another kind of monomer.
5. Like building blocks, monomers link in different ways to form linear, branched, or cross-linked polymers.
6. Polymer chemists are able to make polymer materials designed for specific uses.
7. They can do it controlling the types of monomers.

Exercise 4. Answer the following questions.

1. What is the polymerization?
2. What are the ways of characterization of polymers?
3. How is a block copolymer characterized?
4. What is graft copolymer?
5. Can monomers link?
6. What will be obtained when monomers link together?
7. What help chemists make polymer materials?

Exercise 5. Match the word and phrase with its definition.

1.	degree of polymerization	A.	built up without another
2.	built up solely	B.	showing no clear plan, purpose, or pattern
3.	sequence of the monomers	C.	degree of a chemical reaction in which two or more small molecules combine to form larger molecules
4.	random	D.	to join one thing to another as if by grafting
5.	uninterrupted string	E.	monomer is in the order in which all is or should be connected, related, or dated
6.	graft	F.	involving a single dimension

7. linear	G. extension in three directions
8. branched	H. to put in a particular order
9. cross-linked polymers	I. something extending from a main line or source
10. to arrange	J. a project or scheme in which means to an end are laid down
11. three-dimensional	
12. designed	

Part 3
Polymerization

The term polymer is a composite of the Greek words poly and meros, meaning «many parts.» Polymers are large molecules made of small, repeating molecular building blocks called monomers. The process by which monomers link together to form a molecule of a relatively high molecular mass is known as polymerization.

Polymers make up many of the materials in living organisms. Proteins are polymers of amino acids, cellulose is a polymer of sugar molecules, and nucleic acids such as deoxyribonucleic acid (DNA) are polymers of nucleotides. Many synthetic materials, including nylon, paper, plastics, and rubbers, are also polymers.

A variety of simple molecules join together to become useful polymers. The nonstick cookware coating known as Teflon, for example, is made of a monomer composed of two atoms each of fluorine and carbon. Both Plexiglas and Lucite are made of methyl methacrylate, an organic monomer composed of carbon, hydrogen, and oxygen. Silicon polymers used for sealants and other applications are made from inorganic monomers that contain silicon atoms.

Polymers are made from monomers in one of two ways: by chain, or addition, polymerization or by condensation polymerization. In chain polymerization, monomers are dissolved in a solvent that is later removed. The monomers quickly combine by an addition reaction without losing any atoms, so that the polymer has the same basic formula as the monomer. Condensation polymerization is a slower stepwise reaction. It results in the loss of atoms or atom groups as by-products of the linking monomers. Most condensation polymerizations is a kind of copolymerization, using two or more types of monomers.

(adopted from»polymer.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following keywords are mentioned. Put them in the order they appear in the text.

monomer polymer solid molecule organism polymerization liquid

Exercise 2 Look through the text and give the title to it.

Exercise 3. Are the following statements true or false?

1. The term polymer is a composite of the Greek words poly and meros, meaning «many parts.»
2. Polymers are small ions made of small, repeating molecular building blocks called monomers.
3. Polymers make up many of the materials in living organisms.
4. Proteins are polymers of sugar molecules.
5. Cellulose is a polymer of amino acids.
6. Polymers are made from monomers in one of two ways: by chain, or addition, polymerization or by condensation polymerization.
7. Most condensation polymerizations is a kind of copolymerization, using two or more types of monomers.

Exercise 4. Answer the following questions.

1. What is the origin of the word polymer?
2. What polymers are made of?
3. What is the process of polymerization?
4. What are the ways of making polymers from monomers?
5. Can monomers dissolve in solvent in the chain polymerization?
6. What is condensation polymerization?
7. What does condensation polymerization result in?

Exercise 5. Match the word and phrase with its definition.

1. amino acid	a. any of various acids (as DNA or RNA) composed of a chain of nucleotides and found especially in cell nuclei
2. deoxyribonucleic acid	b. any of numerous acids that include some which are the building blocks of proteins and are made by living cells from simpler compounds or are obtained in the diet
3. nucleic acids	c. allowing easy removal of cooked food particles
4. cellulose	d. a nonmetallic element that occurs combined as the most abundant element after oxygen in the earth's crust and is used especially in alloys and electronic devices see element table
5. nonstick cookware coating	e. a complex carbohydrate that is the chief part of the cell walls of plants and is commonly obtained as a white stringy substance from vegetable matter (as wood or cotton) which is used in making various products (as rayon and paper)

6. synthetic	f. chemical transformation or change: the action between atoms or molecules to form one or more new substances
7. silicon	g. of, relating to, or produced by chemical synthesis; produced artificially
8. polymerization	h. a usually liquid substance capable of dissolving one or more other substances
9. in chain polymerization	i. the act or process of condensing
10. solvent	j. chemical reaction in which two or more small molecules combine to form larger molecules
11. condensation	
12. reaction	

Unit 7. Great Discoveries of the 20th Century

Part 1

Exercise 1. Fill in the gaps with the words from the box. Read the whole paragraph.

spoon achievements inventor compound useful celluloid substance

Some of the most notable (1) … in modern chemistry have come from efforts to create whole new classes of materials.

Early plastics such as (2) … , invented in the late 1860s, relied on large molecules found in natural substances.

In 1909, however, the Belgian-born (3) … Leo H. Baekeland took out a United States patent for a hard, chemically resistant, electrically nonconductive plastic that he called Bakelite.

Made from the chemical combination of synthetic (4) … called formaldehydes and phenols, Bakelite proved to be exceptionally (5) … as an electrical insulator and as a structural material for such consumer goods as radio cabinets, telephone housings, and even jewelry.

Exercise 2. Put the sentences into the proper order. Read the whole paragraph.

a. These research activities led not only to new dyes, drugs, and detergents but also to the successful manipulation of molecules to produce dozens of materials with particular qualities such as hardness, flexibility, or transparency.
b. The commercial success of Bakelite sparked great interest and investment in the plastics industry, in the study of coal-tar products and other organic compounds, and in the theoretical understanding of complex molecules.

Exercise 3. Put the words and phrases of the given sentences into the proper order. Read the whole paragraph.

1. were / developed /Techniques / , elaborate / often requiring / and / equipment / catalysts , / to make these polymers—that is /, complex / from simpler / molecules / structures / built up ./
2. of polymer / From the field / chemistry, / rubber / the synthetic / synthetic fiber / and /industries have grown./
3. are used / Synthetic fibers / in fabrics, carpets, rope,/ and brush bristles / synthetic rubber./and for producing

Exercise 4. Look through the paragraphs above and put them into proper order. Give the title to the whole text.

Exercise 5. Match the word and phrase with its definition.

1. achievement	a. a tough flammable plastic
2. molecule	b. the smallest particle of a substance having all the characteristics of the substance
3. celluloid	c. to create or produce for the first time
4. inventor	d. of, relating to, or produced by chemical synthesis
5. synthetic	e. capable of being bent
6. compound	f. something achieved
7. catalyst	g. made of or by the union of separate elements or parts
8. flexibility	h. a substance that changes the rate of a chemical reaction but is itself unchanged at the end of the process ; esp: such a substance that speeds up a reaction or enables it to proceed under milder conditions
9. polymer	i. composed of two or more parts
10. complex	j. the act of equipping a person or thing
11. hardness	
12. equipment	

(adopted from «chemistry.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Part 2

Synthetic drugs

A dramatic result of the growth in chemical knowledge was the expansion of the modern pharmaceutical industry. Notable early achievements include the development of the synthetic drugs acetylsalicylic acid (aspirin) in 1897, Salvarsan (for treating the bacterial disease syphilis) in 1910, and Prontosil (the first sulfa drug for treating bacterial infections) in 1932, as well as the discovery of the antibiotic penicillin (produced naturally by a mold) in 1928.

Since the late 20th century the rapid growth in the understanding of chemical processes in general, and of organic and biochemical reactions in particular, has revolutionized the treatment of disease. Most drugs available today do not occur naturally but are made in the laboratory from elements and inorganic and organic compounds. Others are derived from animals, plants, microorganisms, and minerals, by pharmaceutical researchers who often use chemical reactions to modify molecular structures in order to make drugs that are more effective and have fewer harmful side effects.

(adopted from «chemistry.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key-words are mentioned. Put them in the order they appear in the text.

pharmaceutical effective penicillin treatment solid expansion chlorine

Exercise 2. What do the key-words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. A dramatic result of the growth in chemical knowledge was the expansion of the modern pharmaceutical industry.
2. Notable early achievements include the development of the science chemistry.
3. Since the late 20th century the rapid growth in the understanding of chemical processes in general, and of organic and biochemical reactions in particular, has revolutionized the treatment of disease.
4. Most drugs available today occur naturally.
5. Most drugs available today do not occur naturally but are made in the laboratory from elements and inorganic and organic compounds.
6. Some drugs are derived from animals, plants, microorganisms, and minerals.
7. Pharmaceutical researchers use chemical reactions to modify molecular structures in order to make drugs that are more effective and have fewer side harmful effects.

Exercise 4. Answer the following questions.

1. What was a dramatic result of the growth in chemical knowledge?
2. What were notable early achievements?

3. When was the antibiotic penicillin discovered?
4. How are most drugs obtained nowadays?
5. Do they occur naturally?
6. Are they derived from animals?
7. Can they have harmful side effects?

Exercise 5. Match the word and phrase with its definition.

1.	pharmaceutical	a.	the act of expanding
2.	penicillin	b.	a substance produced by an organism (as a fungus or bacterium) that in dilute solution inhibits or kills a harmful microscopic plant or animal and especially one that causes disease
3.	acetylsalicylic acid	c.	to form by combining parts
4.	drug	d.	any of several antibiotics or a mixture of these produced by penicillia or in the laboratory and used especially against round disease-producing bacteria
5.	antibiotic	e.	a substance used as a medicine or in making medicines
6.	disease	f.	aspirin
7.	expansion	g.	of, relating to, or involved in pharmacy or the manufacture and sale of medicinal drugs
8.	compound	h.	causing damage
9.	researcher	i.	the smallest particle of a substance having all the characteristics of the substance
10.	naturally	j.	careful study and investigation for the purpose of discovering and explaining new knowledge
11.	harmful		
12.	molecule		

Part 3

Nuclear Chemistry and Atomic Structure

In 1896, Henri Becquerel and Marie and Pierre Curie discovered the phenomenon of radioactivity. Thus scientists were shown that atoms were not permanent and changeless, and the basis was laid for nuclear chemistry and nuclear physics. Having found that atoms sometimes transmuted into other elements on their own, scientists attempted to do the same in the laboratory. In 1919 Ernest Rutherford became the first to succeed, using natural radioactivity to transmute nitrogen atoms into atoms of oxygen and hydrogen. In 1934 Frédéric and Irène Joliot-Curie made radioactive isotopes of elements that were not normally radioactive. Five years later Otto Hahn, Fritz Strassmann, and Lise Meitner discovered that the uranium nucleus could be made to fission, or split into the nuclei of lighter elements, by bombarding it with uncharged particles called neutrons.

By the early 1940s nuclear reactions had been used to make radioactive isotopes of all elements; Glenn Seaborg contributed much to this work. In the 1940s and '50s Seaborg and his co-workers also made several elements not known to exist in nature. The new elements had atomic numbers greater than 92, the atomic number of uranium. By the early 21st century nuclear scientists were adding new elements to the periodic table with atomic numbers higher than 110.

Rutherford's discovery in 1911 that the atom has a tiny massive nucleus at its center allowed chemists and physicists such as Gilbert Lewis, Irving Langmuir, and Niels Bohr over the next 20 years to explain chemical bonding and atomic structure in terms of the behavior of electrons orbiting the nucleus. In the late 1920s and early 1930s, Linus Pauling contributed much to knowledge of the nature of the chemical bond and of the relationship between the structure of atoms and molecules and their properties.

(adopted from «nuclear chemistry.» Britannica Student Library. Encyclopædia Britannica. Chicago: Encyclopædia Britannica, 2007.)

Exercise 1. Look through the text and define which of the following key-words are mentioned. Put them in the order they appear in the text.

radioactivity	tube	phenomenon	isotope	nitrogen	nucleus	cup

Exercise 2. What do the key-words from Exercise 1 refer to?

Exercise 3. Are the following statements true or false?

1. In 1896, Dmitrii Mendeleyev discovered the phenomenon of radioactivity.
2. Scientists were shown that atoms were not permanent and changeless, and the basis was laid for nuclear chemistry and nuclear physics.
3. By the early 1940s nuclear reactions had been used to make radioactive isotopes of all elements; Glenn Seaborg contributed much to this work. In the 1940s and '50s Seaborg and his co-workers also made several elements not known to exist in nature.
4. The new elements had atomic numbers greater than 107, the atomic number of uranium.
5. By the early 21st century nuclear scientists were adding new elements to the periodic tale with atomic numbers higher than 110.
6. In the late 1920s and early 1930s, Linus Pauling contributed much to knowledge of the nature of the chemical compound.
7. He also dealt with the relationship between the structure of atoms and molecules and their properties.

Exercise 4. Answer the following questions.

1. Who discovered the phenomenon of radioactivity?
2. What happened in 1919?
3. What nuclear reactions had been used by the early 1940s?
4. When did Seaborg and his co-workers also make several elements not known to exist in nature?
5. What were these elements?
6. What Rutherford's discovery allowed to do?
7. What was Linus Pauling' contribution?

Exercise 5. Match the word and phrase with its definition.

1. nuclear	a. the smallest particle of a substance having all the characteristics of the substance
2. phenomenon	b. a silvery heavy radioactive metallic element see element table
3. permanent	c. a chemical element that is the simplest and lightest of all chemical elements and is normally found alone as a colorless odorless highly flammable gas having two atoms per molecule see element table
4. uranium	d. lasting or intended to last for a very long time : not temporary or changing lasting
5. bombarding	e. a rare or important fact or event
6. molecule	f. being or relating to energy or a weapon that involves a nuclear reaction
7. scientist	g. a reactive element that is found in water, rocks, and free as a colorless tasteless odorless gas which forms about 21 percent of the atmosphere, that is capable of combining with almost all elements, and that is necessary for life see element table
8. isotope	h. the giving off of rays of energy or particles by the breaking apart of atoms of certain elements (as uranium)
9. nitrogen	i. any of the forms of an element that differ in the number of neutrons in an atom
10. radioactivity	j. a colorless tasteless odorless element that occurs as a gas which makes up 78 percent of the atmosphere and that forms a part of all living tissues see element table
11. oxygen	
12. hydrogen	

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