МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ЧЕРКАСЬКИЙ НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ
ІМЕНІ БОГДАНА ХМЕЛЬНИЦЬКОГО

Г. В. Карловська

English for the Students of Natural Sciences

Методичні вказівки щодо організації самостійної роботи
з англійської мови для студентів ННІ природничих наук
галузей знань “Хімія ”та “Біологія”

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Методичні вказівки розроблено для вивчення англійської мови (за професійним спрямуванням) студентами ННІ природничих наук галузей знань “Хімія ”та “Біологія”.

Методичні вказівки містять завдання для самостійної роботи студентів у галузі знань “Хімія ” та “Біологія”, а також рекомендації щодо процедури їхнього виконання. До їхньої структури увійшли: двадцять один текст для читання та вправи для самоконтролю на перевірку розуміння прочитаного.

Методичні вказівки призначаються для студентів І-ІІ курсів денної форми навчання, а також для всіх охочих прочитати цікаві тексти з природничої тематики.

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ВСТУП

Методичні вказівки призначається для студентів І-ІІ курсів ННІ природничих наук галузей знань “Хімія” та “Біологія”. Методичні вказівки мають на меті пояснити, яким чином слід продовжувати вивчення іноземної мови у формі самостійної роботи. Вони містять практичні поради та рекомендації щодо процесу поглиблення знань із цієї дисципліни.

Самостійна робота – це спланована пізнавальна, організаційно та методично направлена діяльність, яка здійснюється без прямої допомоги викладача, на досягнення результату.

На початок самостійної роботи з текстами професійної тематики студентам слід володіти лексичним мінімумом та граматичними знаннями загальної англійської мови. Тому доводиться поєднувати правила функціювання мови та специфіку конкретної галузі знань.

Мета цих методичних вказівок – навчити студентів користуватися словниками, довідниками та іншою навчальною літературою під час самостійної роботи з іншомовними текстами задля отримання корисної інформації професійного напряму.

Алгоритм виконання роботи включає такі етапи:

- читання тексту та письмова фіксація незнайомих слів, що зустрічаються у тексті;
- опрацювання виписаних слів за допомогою словника (запис транскрипції та перекладу, що відповідає запропонованому контексту);
- усний переклад тексту з опорою на значення нової лексики;
- у разі потреби, формулювання проблемних аспектів у письмовому вигляді з метою консультації з викладачем;
- виконання вправ для самоперевірки після тексту в усному та письмовому вигляді.

Матеріал поділено на двадцять один текст для читання та вправи для самоконтролю на перевірку розуміння прочитаного.

Кожний розділ складається з тексту, який містить спеціальну наукову термінологію, та лексичних післятекстових

вправ, за допомогою яких формуються навички говоріння, читання, письма, розуміння англійських текстів в межах поданих тем.

Вправи дають змогу студентам закріпити нову лексику та розвивають вміння використовувати її в усному та писемному мовленні.

Всі теми даного посібника викликають зацікавленість та розвивають самостійну пізнавальну діяльність студентів.

BIOCHEMISTRY

Animal and plant life contains a wide variety of organic and inorganic compounds. Biochemistry is the study of compounds involved in biological processes and the changes they undergo during life processes. The field of biochemistry is one of the frontiers of science. Many exciting discoveries are being made by biochemists. Such discoveries range from the establishment of a theory to the development of drugs and vaccines to cure diseases. Biochemists and molecular biologists have developed methods to alter the genes of bacteria and yeasts so that they can be used to manufacture useful proteins. These methods are the basis for the new field of biochemistry. The list of products being manufactured or considered for manufacture by biotechnological methods includes insulin, interferon (used to treat infections and inhibit tumour growth), the enzyme urokinase (used to dissolve blood clots), rennin (used in cheese making), and cellulase (used to make sugar from cellulose). It would be impossible for humans to manufacture these compounds without modern methods of biotechnology.

Living organisms are an enormously complex mixture of various kinds of chemical compounds that act in concert to maintain life. Considering the great diversity of plants and animals, it is amazing that many of the same chemical compounds and chemical processes are shared by all life forms.

Most biochemical compounds are organic. Combined hydrogen, oxygen, carbon, and nitrogen make up about 99% of the atoms of living organisms. Calcium, chlorine, magnesium, phosphorus, iron, potassium, sodium, and sulphur in the form of ions and in compounds make up most of theremaining 1%. Many other elements are present is small amounts as trace elements that are essential to life processes.

Biochemistry derives most of its knowledge from observations that are made by the chemical and physico-chemical analysis of the constituents of the various organic structures of plant and animal tissues or of constituents that once were present as a part of tissues. The knowledge that is gained by observations on each differentiated tissue must ultimately be interrelated with the reactions of the organism as a whole. The organism in turn can never be separated from its

environment. The environment of an organism is very complex. It is formed by all the conditions with which the organism must cope.

All biological data must necessarily be obtained under various conditions of environment. Considerable variability is shown even by individuals of the same species. For this reason normal values are obtained only when an organism and its environment are in approximate adaptation or harmony.

exciting discoveries / ɪk'saɪtɪŋ dɪs'kʌvərɪz / захоплюючі відкриття
heredity / hɪ'redɪtɪ / спадковість
molecular biologist / mo(u)'lekju:lə baɪ'ɔlɔdʒɪst / молекулярний біолог
useful proteins / 'ju:sful 'prouti:nz / корисні білки
biotechnological / ˌbaɪəteknə'lɔdʒɪkl / біотехнологічний
plant tissue/ 'pla:nt 'tɪsju: / рослинна тканина
trace elements / 'treɪs 'elɪmənts / мікроелементи

1. Answer the questions:

1) What does biochemistry study?
2) What methods have biochemists and molecular biologists developed?
3) What are living organisms?
4) Where does biochemistry derive most of its knowledge from?
5) What is the environment of an organism formed by?

2. Choose the wright variant:

1) Living organisms are an enormously complex mixture of various kinds of … .
   a) atoms
   b) physical compounds
   c) chemical compounds
2) Most biochemical compounds are … .
   a) organic
   b) inorganic
   c) mixed
3) The organism … separated from its environment.
   a) can be
   b) can never be
   c) must be

3. Tell true or false:

1) Combined neon, oxygen, carbon, and nitrogen make up about 99% of the atoms of living organisms.
2) Biochemistry derives most of its knowledge from observations that are made by the chemical and physico-chemical analysis of the constituents of the various organic structures of plant and animal tissues or of constituents that once were present as a part of tissues.
3) The list of products being manufactured or considered for manufacture by biotechnological methods includes insulin, interferon, the enzyme urokinase, rennin and cellulase.
4) All biological data must necessarily be obtained under various conditions of environment.

4. Write a plan to retell the text.

BIOLOGY

UNIT I

Biological Variation

Biochemistry derives most of its knowledge from observations that are made by the chemical and physicochemical analysis of the constituents of the various organic structures of plant and animal tissues or of constituents that once were present as a part of tissues. The knowledge that is gained by observation on each differentiated tissue must ultimately be interrelated with the reactions of the organism as a whole. The organism in turn can never be separated from its environment.

The environment of an organism is very complex. It is formed by all the conditions with which the organism must cope. For example, clothing, food, water, shelter, the air, the ground, the fluids that bathe the tissues, the presence of other organisms, and all other conditions that are characteristic of life are aspects of the environment.

All biological data must necessarily be obtained under various conditions of environment, and since the adaptation of an organism to its environment is one of degree only, considerable variability is shown even by individuals of the same species. For this reason, normal values are obtained only when an organism and its environment are in approximate adaptation and harmony.

The errors of observation that are made upon biological material are often very great. This is due to the variability that is shown by different individuals even though the methods that are used to make the observations may be those of the exact science in which the errors are very small.

In order to overcome the handicap of biological variation and to prove a sound basis for biological values, all experiments that are used to furnish evidence must be correctly designed so that the results will yield the information of the primary factors, as well as the interrelationships with the experiment it concerned.

biological data / baɪə'lɔdʒɪkəl 'deɪtə / біологічні данні

various conditions / 'vɛərɪəs kən'dɪʃənz / різні умови
same species / 'seɪm 'spi:ʃi:z / одні й ті ж види
errors of observation / 'erəz əv ˌɔbzə: 'veɪʃən / помилки спостереження
due to the variability / dju: tə ðə ˌvɛərɪə'bɪlɪtɪ / через мінливості
exact science / ɪk'zekt ' saɪəns / точна науки
overcome the handicap / ouvə' kʌm ðə 'hændɪkəp / подолати перешкоду
furnish evidence / ' fə:nɪʃ ' evɪdəns / надати докази

1. Answer the questions:

1) What does biochemistry derive most of its knowledge from?
2) Can organism be separated from its environment?
3) What is the environment of the organism formed by?
4) Under what conditions must all biological data be obtained?
5) What are the errors of observation due to?
6) What must experimenters do in order to overcome the handicap of biological variation?

2. Choose the wright variant:

1) The organism i can never be separated from its … .
   a) observation
   b) environment
   c) variability
2) The environment of an organism is … .
   a) very complex
   b) very simple
   c) biological
3) The errors of observation that are made upon biological material are often … .
   a) minor
   b) not very great
   c)very great

3. Tell true or false:

1) The environment of an organism is formed by all the conditions with which the organism must cope.

2) All biological data must necessarily be obtained under various conditions of environment.
3) Normal values are obtained only when an organism and its environment are not in approximate adaptation and harmony.
4) In order to overcome the handicap of biological variation and to prove a sound basis for biological values, all experiments that are used to furnish evidence must be correctly designed.

4. Write a plan to retell the text.

UNIT II

Orders of Reptiles

Alligators and crocodiles are long, four-limbed animals with scales or plates covering their bodies. They are very much alike, and it takes an expert to tell them apart. In both, the fourth tooth in the lower jaw is larger than the others. This is clearly seen in the crocodile when its mouth is closed, but the alligator's fourth tooth cannot be seen when the mouth is closed.

Both alligators and crocodiles have their eyes, ear-slits and nostrils on the top of their long flat heads so that they can see, hear and breathe in the water with only the top of the head showing. They swim by means of their strong tails and use their legs only for walking or running. They eat only animal food, chiefly fish. All lay oval, hard-shelled eggs which are hatched out by the heat of the sun or by rotting vegetable matter.

Turtles and tortoises can be at once distinguished from other reptiles by their bony shells, which are covered with horny shields. Usually they can draw the head, legs and tail under this covering. They have toothless jaws covered with a sharp, horny substance, and all lay eggs.

In Britain the word tortoise generally means the land animal, which is often kept as a pet, and freshwater tortoises are called terrapins. The word turtle generally means the ones that live in the sea. In the United States, however, all are usually known as turtles.

The order that includes the lizards and snakes is by far the largest order of reptiles, for there are more than 2,500 species (kinds) of lizards and about 3,000 species of snakes. Lizards are generally harmless, only one kind, the Gila monster, is poisonous. However, many snakes have poison fangs.

Lizards have visible ear openings, but the ears of snakes are hidden under the skin. The lower jaw of a lizard is formed in one piece, but the two halves of a snake's lower jaw are joined together by a piece of an elastic-like substance. The lower jaw can be stretched very wide, so that a snake can swallow prey larger than its head.

reptiles / 'reptaılz / рептилії
alligator / 'ælıgeıtə / алігатор

crocodile / ' krɔkədaıl / крокодил
lizard / ' lizəd / ящірка
snake / 'sneık / змія
poisonous / 'pɔızənəs / отруйний
jaw / 'dʒɔ: / щелепи

1. Answer the questions:

1) Are alligators and crocodiles very much alike?
2) What are distinctive features of alligators and crocodiles?
3) By what can turtles and tortoises be at once distinguished from other reptiles?
4) How many kinds of the lizards and snakes are there?
5) What can you say about the ears and jaws of the lizards and snakes?

2. Choose the wright variant:

1) Reptiles swim by means of their... .
   a) strong tails
   b) strong legs
   c) strong hands
2) Turtles and tortoises... .
   a) lay eggs
   b) give birth to a baby
   c) eat eggs
3) The lower jaw of a lizard is formed... .
   a) in a piece of an elastic-like substance
   b) in two pieces
   c) in one piece

3. Tell true or false:

1) Both alligators and crocodiles have their eyes, ear-slits and nostrils on the top of their long flat heads.
2) They eat only grass and eggs.
3) The word tortoise generally means the land animal.
4) Many snakes have no poison fangs.

4. Write a plan to retell the text.

UNIT III

Our Planet

The Earth is nearly spherical planet with a diameter of about 12,800 kilometers. By analysing vibrational waves created by earthquakes, geologists have divided the earth's interior into three major spherical zones or shells – crust, mantle, and core according to differences in structure and composition.

For over 4.5 billion years, Earth has been changing. This process is called dynamic, changing all the time. Some changes, like earthquakes, happen in seconds. Other changes, such as the carving the Grand Canyon, take millions of years. Earth is made up of different layers.

Inner core. A solid ball made of two metals – iron and nickel. It's hotter here than on the sun.

Outer core. This liquid layer made of iron and nickel moves around the inner core. This motion causes Earth to act like a giant magnet and makes compasses work and help birds navigate.

Mantle. Hard as rock, but it flows around the outer core – very slowly. This movement causes volcanoes, earthquakes, and mountains. The largest zone of the earth's interior is rich in silicon, oxygen, magnesium and iron. The fluidlike portion of the mantle is called asthenosphere.

Crust. Where we live is about 22 miles thick. This relatively thin shell of fairly rigid rock makes up only 1% of the earth's volume. It consists of the continental and the oceanic crust.

Atmosphere. This layer of Earth is the air we breathe. The atmosphere blocks out dangerous rays from the sun and acts like a giant blanket to keep the planet warm.

Earth spins at about 1,000 miles per hour at the equator. That's twice as fast as a jet plane. The ground beneath is always on the move. To be specific, it's the continents we live on that are changing position – about 1 inch every month.

Oceans and seas cover almost 75% of the planet. Their powerful currents spread the sun's heat around the planet. This keeps the temperature from getting too hot or too cold. Water makes life possible.

The earth's crust is composed of minerals and rocks, and is the source of all the nonrenewable resources we use, such as fossil fuels and minerals. A mineral is a naturally occurring inorganic solid with a particular chemical composition and a crystalline internal structure. Some minerals consist of a single element, such as gold, silver, diamond (carbon), and sulphur. However, most of the more than 2,000 identified minerals occur as inorganic compounds of the ten elements. A rock is a combination or aggregate of minerals.

Over millions of years various geological, physical and chemical processes have concentrated certain minerals in deposits in the earth's upper crust. A deposit in which the concentration of a mineral is high enough to make its recovery profitable is called an ore.

inner core / 'ınə 'kɔ: / внутрішнє ядро
outer core / 'autə 'kɔ: / зовнішнє ядро
liquid layer / ' lıkwıd ' leıə / рідкий шар
giant magnet / ' dʒaıənt ' mægnət / величезний магніт
dangerous rays / 'deındʒrəs 'reız / небезпечне проміння
jet plane / 'dʒet 'pleın / реактивний літак
powerful currents / 'pauəful 'kʌrənts / потужні течії

1. Answer the questions:

1) What metals is inner core made of?
2) What moves around the inner core?
3) What does this motion cause?
4) What does the movement of mantle cause?
5) What role does the atmosphere play?

2. Choose the wright variant:

1) Geologists have divided the earth's interior into three major spherical zones or shells: ... .
   a) land, mantle, and core
   b) crust, mantle, and core
   c) crust, mantle, and sky
2) The fluidlike portion of the mantle is called ... .
   a) outer core
   b) liquid layer
   c) asthenosphere

3) A mineral is a naturally occurring ... with a particular chemical composition and a crystalline internal structure.
   a) inorganic solid
   b) organic solid
   c) inorganic liquid

3. Tell true or false:

1) Inner core is a solid ball made of two metals – iron and nickel.
2) The atmosphere acts like a giant blanket to keep the planet cool.
3) Oceans and seas cover almost 86% of the planet.
4) All minerals consist of a single element, such as gold, silver, carbon, and sulphur.

4. Write a plan to retell the text.

UNIT IV

Ecology and Ecosystems

Ecology is the science that tries to answer such questions about how nature works. In 1869 German biologist Ernst Haeckel coined the term *ecology* from two Greek words: *oikos,* meaning «house» or «place to live», and logos, meaning «study of».

Ecology is the study of living things in their home or environment: all the external conditions and factors, living and nonliving that affect an organism. In other words, ecology is the study of interaction between organisms and their living and nonliving environment. Scientists usually carry out this study by examining different ecosystems: forests, deserts, grasslands, ponds, lakes, oceans or any organisms interacting with one another and with their nonliving environment.

The Earth has several major parts that play a role in sustaining life. We are part of what ecologists call the biosphere – the living and dead organisms found near the earth's surface. Virtually all life on earth exists in a thin film of air, water and rock in a zone extending from about 61 meters below the ocean surface to 6,000 meters above sea level.

The living organisms that make up the biosphere interact with one another, with energy from the sun, and with various chemicals in the atmosphere, hydrosphere and lithosphere. This collection of organisms that make up the biosphere interact with one, with energy from the sun, and with various chemicals in the atmosphere, hydrosphere and lithosphere. This collection of organisms interacting with one another and their nonliving environment is called the ecosphere. The goal of ecology is to learn how the ecosphere works.

Ecosystems consist of various nonliving and living components. The nonliving or abiotic components include various physical and chemical factors. Among physical factors affecting ecosystems are sunlight and shade, temperature, precipitation, wind, soil, fire, etc. Major chemical factors include: level of water and air in soil, level of nutrients, level of toxic substances, sanity of water and some others.

The major types of organisms that make up the living or biotic components are usually classified as producers, consumers and

decomposers. This classification is based on organisms' general nutritional habits. Green plants are producers as they make the organic nutrients through photosynthesis. Only producers can make their own food. They provide food directly or indirectly animals and decomposers. We get nutrients either by eating plants or by eating animals that feed on plants.

Organisms that get the nutrients and energy they require by feeding either directly or indirectly on producers are called consumers or heterotrophs (other-feeders).

Some consumers feed on living plants and animals, the others feed on small fragments of dead plants and animals matter, called detritus. Detritus consumers called decomposers digest dead tissue or wastes and absorb their soluble nutrients. Decomposers consist of two classes: called bacteria and fungi. Bacteria and fungi decomposers in turn are an important source of food for organisms such as worms and insects living in the soil and water.

There is no waste in functioning biological communities; the wastes of one form of life are food or nutrients for other forms of life. This is how no-waste-in-nature principle work.

coin the term / 'kɔın ðə 'tə:m / створити новий термін
external conditions / eks'tə:nl kən'dıʃənz / зовнішні умови
different ecosystems / 'dıfrənt ıkə'sıstəmz / різні екосистеми
various chemicals / 'vɛərıəs 'kemıkəlz / різні хімічні елементи
below the ocean's surface / [bı'lou ðı 'ouʃənz 'sə:fıs / нижче поверхні океану
above sea level /ə'bʌv 'si: 'levəl / вище рівня моря
earth surface / 'ə:θ 'sə:fıs / поверхня землі

1. Answer the questions:

1) What is ecology?
2) How was the term ecology coined?
3) What are the components of biosphere?
4) What is the ecosystem and what are its major living and nonliving components?
5) What happens to matter in an ecosystem?
6) How do organisms interact in an ecosystem?

2. Choose the wright variant:

1) Virtually all life on earth exists in a thin film of ... in a zone extending from about 61 meters below the ocean surface to 6,000 meters above sea level.
   a) water and rock
   b) air and rock
   c) air, water and rock
2) The goal of ecology is ... .
   a) to learn the life of human beings
   b) to learn how the ecosphere works
   c) to learn how to escape war
3) Among physical factors affecting ecosystems are … .
   a) sunlight and shade, temperature, precipitation, wind, soil, fire
   b) level of water and air in soil, level of nutrients, level of toxic substances
   c) sunlight and shade, level of nutrients, level of toxic substances

3. Tell true or false:

1) We get nutrients either by eating rocks or by eating animals that feed on plants.
2) Green plants are producers as they make the organic nutrients through photosynthesis.
3) Decomposers consist of two classes: calledbacteria and fungi.
4) Producers can't make their own food.

4. Write a plan to retell the text.

UNIT V

Global Warming and Greenhouse Effect

The Earth's climatic history saw thousands of years of climate changes and fluctuations in levels of greenhouse gases. These changes led to eight great ice ages over the last 700 thousands years. Each of these glacial periods lasted about 100,000 years and was followed by a warmer interglacial period, lasting 10,000-12,500 years.

The greenhouse theory was first proposed in 1827 by the French mathematician Jean Baptiste Fourier. Today, most scientists believe it to be valid. Currently, carbon dioxide accounts for about 49 per cent of the annual human-caused input of greenhouse gases, chlorofluorocarbons for 14per cent, methane for 8 per cent, and nitrous oxide for 6 per cent. Carbon dioxide is released when carbon or any carbon-containing compound is burned. Fossil fuels provide about 80% of the world's energy and produce most of the air pollution.

Another reason of 20 per cent increase in carbon dioxide levels is deforestation, especially burning in tropical forests. Modern agriculture, industries and cars also release greenhouse gases, mostly methane, into the troposphere.

Since 1880, when reliable measurements began, average global temperatures have risen about 0,5C. Current climatic models project that the average temperature will rise 1.5°C to 5.5°C by2040, if the greenhouse input continues at the current rate. Scientists predict that the Northern Hemisphere will warm more and faster than the Southern Hemisphere, because there is more ocean in the south and water takes longer to warm than land. A rise of 5°C would make the earth warmer than it was millions of years and would cause unpredictable disruption of ecological, economic and social systems.

greenhouse effect / 'gri:nhaus ɪ'fekt / парниковий ефект
fluctuation / ˌflʌktju'eɪʃn / вагання
interglacial / ˌɪntə'gleɪsɪəl / міжльодовиковий
carbon-containing compound / 'ka:bən kən'teɪnɪŋ / карбоно-місна сполука
deforestation / dɪ'fɔrɪs'teɪʃən / вирубування лісів

1. Answer the questions:

1) How long did each of the glacial periods last?
2) By whom was greenhouse theory first proposed?
3) When is carbon dioxide released?
4) What is deforestation?
5) What do current climatic models project?

2. Choose the wright variant:

1) Each of the glacial periods lasted about … and was followed by a warmer interglacial period.
   a) 1,000,000 years
   b) 100,000 years
   c) 10,000 years
2) Carbon dioxide is released when ... compound is burned.
   a) carbon or any carbon-containing
   b) hydrogen or any hydrogen-containing
   c) oxygen or any oxygen -containing
3) Modern agriculture, industries and cars also release greenhouse gases, ..., into the troposphere.
   a) mostly radium
   b) mostly silicon
   c) mostly methane

3. Tell true or false:

1) The Earth's climatic history saw thousands of years of fluctuations in levels of greenhouse gases.
2) Another reason of 20 per cent increase in carbon dioxide levels is low temperature.
3) Scientists predict that the Northern Hemisphere will warm more and faster than the Southern Hemisphere.
4) A rise of 5°C would make the earth colder than it was millions of years and would cause unpredictable disruption of ecological, economic and social systems.

4. Write a plan to retell the text.

UNIT VI

Blue Whale

Everything about the blue whale is enormous. It is the largest animal on earth, ever. A big blue whale can be 100 feet long and weigh up to 150 tons. That's as large as a Boeing jet. Its heart is as large as a small car. Fifty people could stand on its tongue. Its spout shoots up at least 30 feet when it surfaces for

A whale's "nostrils" are called blowholes and are on the top of its head. Some whales have one blowhole and others, like this blue whale, have two. Unlike humans, whales breathe voluntarily. That means they choose when to take a breath. This is important because whales can't breathe underwater. They surface every few minutes to blow out a mixture of water and air and take in a breath of fresh air.

Just like you and me, whales have bellybuttons. Like all mammals, they give birth and nurse live young. The bellybuttons is what remains of the umbilical cord.

Like all whales, the blue whale is a mammal rather than a fish. It is warm-blooded, has lungs rather than gills, and nourishes its young with milk. A blue whale's milk supposedly tastes like a mixture of fish, liver, milk of magnesia, and castor oil. But it's very rich and nourishing for baby blues. A baby blue whale drinks over 50 gallons of its mother's milk in a day. In its first several weeks of life, it gains 10 pounds an hour or a little over 200 pounds a day! When a baby blue whale is about 6 months old, it starts to eat small shrimp-like animals called krill. During its high feeding season, a blue whale consumes more than 4–6 tons of krill in one day. It's hard to imagine, but the world's biggest animal eats animals that are less than 1/1000th its size. In order to get enough to eat, a full-grown blue whale might eat 40 million krills in one day.

In order to get that much to eat, a blue whale can expand its throat to take in as much as 50 tons of water in one gulp. Then it forces the water out through comb-like plates which keep the krill in and let the water filter out. These huge plates are called baleen. Baleen is made of the same material as our fingernails.

All whales have amazing adaptations that help them survive in the ocean. Whales don't sleep like you and me. If they did, they would

drown. Instead, whales take very short naps, often floating near the surface of the ocean. Whales rely on their thick layers of blubber to keep them warm in cold waters.

While we know a lot about whales and we are learning more every day, there are still some questions we haven't been able to answer. We know blue whales migrate from polar waters where they feed to warmer, temperate waters where they breed and have babies. But no one's sure how blue whales navigate these long distances. It's possible that they have the ability to detect the Earth's magnetic field and use it as a map or a compass. To a small degree, blue whales probably also use their eyes. Recently, some scientists have come up with a new theory about how blue whales navigate. Because blue whales can produce really loud sounds, it's possible that they use these sounds to sense geographical features of the ocean floor. When whales make sounds and then listen to the pattern of returning echoes to help them find direction or find objects, this is called echolocation.

Blue whales may also make sounds to communicate with other whales and to find a mate. Imagine what it would be like to be the biggest animal in the world swimming alone through the cold ocean waters.

foot *(pl* feet /fi:t/) фут = 30,5 см
jet / dʒet / *розм.* реактивний літак
spout / spaut / дихальний отвір (у кита); стовп води
shoot up / ʃut / підніматися
surface / 'sə:fɪs / випливати на поверхню
nostril / 'nɔstrɪl / ніздря
blowhole / 'blouhoul / дихало (у кита)
bellybutton / 'belɪˌbʌtn / пуп
mammal / 'mæml / ссавець
gulp / gʌlp / великий ковток
force / fɔ:s / видавлювати
baleen / bə 'li:n / китовий вус
drown / draun / тонути
nap / næp / короткий сон
breed / bri:d / вигодовувати
navigate / 'nævɪgeɪt / плавати

come up with – висувати теорію
pattern / 'pætn / зразок
echo / 'ekou / відголос, луна
mate / meɪt / самець; самиця

1. Answer the questions:

1) Why is the blue whale the largest animal on earth?
2) How do whales breathe?
3) How do whales breed their babies?
4) How do whales sleep?
5) In what way do blue whales navigate?

2. Choose the wright variant:

1) A big blue whale can be...long.
   a) 100 tons
   b) 100 feet
   c) 150 feet
2) A baby blue whale drinks over...of its mother's milk in a day.
   a) 10 pounds
   b) 200 pounds
   c) 50 gallons
3) Blue whales may also make sounds... .
   a) to communicate with other whales and to find a mate
   b) to kill people
   c) to seek their house

3. Tell true or false:

1) Like humans, whales breathe voluntarily.
2) Whales have bellybuttons.
3) During its high feeding season, a blue whale consumes more than 50 tons of krill in one day.
4) Whales take very short naps, often floating near the surface of the ocean.

4. Write a plan to retell the text.

UNIT VII

Any New News About Dinosaurs?

Dinosaurs, those amazing creatures of long ago, are still as fascinating as ever. And scientists are learning more about them all the time. What's new about dinosaurs?

One important fossil discovery took place in China in 1987. If you're a dinosaur lover, you know that fossils are the remains of plants or animals that lived long ago. Maybe the fossil is the print of the living thing found in rock, or in ice or mud. The new discovery was wonderful: the skeleton of a new type of prehistoric animal. This was no ordinary dinosaur. When it lived, it had feathers. What was it?

In some ways, the new skeleton was like a bird's. But in other ways, the bones were like a dinosaur's. Scientists have long believed that birds are descended from dinosaurs, and this fossil added more proof. Back in 1861, scientists discovered the fossil of a winged animal about the size of a crow. They named it Archaeopteryx, which means "ancient wing." Although it had wings and feathers, it also had a skeleton like those of its wingless dinosaur cousins.

This new fossil, however, is different. Researchers who have studied it say it is much more like the birds we see today than Archaeopteryx was. In fact, the age of the fossil is about 135 million years. This puts it halfway between Archaeopteryx, which lived ten million years earlier, and the previously discovered modern birds that lived about ten million years later.

The new fossil is only the size of a sparrow, and some of its bones were so small and delicate that scientists used a microscope to study their fossil imprint.

Speaking of birds, some scientist believe dinosaurs may have been more birdlike than they first thought. For a long time, it was thought that dinosaurs were cold-blooded, like todays reptiles. Cold-blooded animals need the sun to warm them. When they are warm, they can move quickly. When they are cold, they are slow and sluggish.

In the last several years, however, many scientists have come to agree that some dinosaurs were probably warm-blooded, like birds and mammals. If they were, then dinosaurs may have moved a lot

faster than anyone ever thought. Scientists have found footprints, preserved in mud that hardened into rock, made by a dinosaur that ran for a long time without stopping. Today's reptiles, being cold-blooded, don't have enough energy to do that.

Dinosaurs lived such a long time ago that sometimes it's hard to believe they really existed. But they really did, and we get to learn more about them all the time.

dinosaur / 'daɪnəsɔ: / дінозавр
amazing / ə'meɪzɪŋ / дивний
fossil / 'fɔsl / викопна тварина
remains / rɪ'meɪnz / скам'янілість
winged / wɪŋd / крилатий
archaeopteryx / ˌɑ:kɪ'ɔpterɪks / археоптерікс
cold-blooded / ˌkould'blʌdɪd / холоднокровний
warm-blooded / ˌwɔ:m'blʌdɪd / теплокровний
mammal / 'mæml / ссавець

1. Answer the questions:

1) When and where did one important fossil discovery take place?
2) What was the new discovery?
3) What was the skeleton like?
4) What is the age of the fossil?
5) Were dinosaurs cold-blooded or warm-blooded?

2. Choose the wright variant:

1) Back in 1861, scientists discovered the fossil of a winged animal about the size of … .
   a) a crow
   b) an elephant
   c) a mouse
2) Cold-blooded animals need ... to warm them.
   a) water
   b) the sun
   c) snow
3) The word *archaeopteryx* means … .
   a) "ancient wing"

b) "big bird"
c) "old animal"

3. Tell true or false:

1) Fossils are the remains of plants or animals that lived long ago.
2) The bones of the new skeleton were like a crocodile's.
3) Some scientist believe dinosaurs may have been more birdlike than they first thought.
4) Dinosaurs were probably warm-blooded, like birds and mammals.

4. Write a plan to retell the text.

UNIT VIII

How Can Fish Breathe?

Have you ever watched a fish in a pond, darting from rock to rock, swimming here and there? That fish can keep swimming all day. It never has to come up for air. When you stop to think about it, fish can do something that's pretty amazing to us human beings: They can breathe underwater. How do they do it?

People and fish need the same thing: oxygen. But they get it from different places. People get oxygen from the air, using their lungs. When you breathe in, the air goes deep into your lungs, where it meets thin, tiny tubes carrying blood, called capillaries. Oxygen in the lungs passes through the capillary walls and enters the blood that's flowing along inside it. The blood flows through your whole body through larger tubes, and oxygen is carried, too. Meanwhile, some of the oxygen you breathe changes into a gas called carbon dioxide. You get rid of extra carbon dioxide when you breathe out. Blood vessels, all the tubes that carry blood inside you, work together with your lungs as you breathe in and out.

A fish, on the other hand, gets its oxygen from the water. Instead of lungs, the fish has special parts called gills. There are two sets of gills, one on each side of the head.

In order to breathe, the fish opens its mouth and lets some water in. The water passes through a valve in the mouth and then flows through the gill sections. When water flows over the gills, oxygen from the water goes into the fish's blood. At the same time, extra carbon dioxide in the blood goes into the water.

There are a few kinds of fish that can also breathe air. One kind is called the lungfish. It has a simple type of lung, in addition to its gills. But most fish would "drown" if you took them out of water. They can't breathe air any better than we can breathe water.

amazing / əˈmeɪzɪŋ / дивний
oxygen / ˈɔksɪdʒən / кисень
capillary / kə ˈpɪlərɪ / капіляр
carbon dioxide / daɪˈ ɔksaɪd / вуглекислий газ
valve / vælv / клапан

1. Answer the questions:

1) Where can fish breathe?
2) How do people breathe?
3) Into what substance does some of the oxygen you breathe change?
4) From what does a fish get its oxygen?
5) What is the lungfish?

2. Choose the wright variant:

1) Fish can keep ... all day.
   a) running
   b) swimming
   c) walking
2) You get rid of extra carbon dioxide ....
   a) when you breathe out
   b) when you eat
   c) when you sleep
3) In order to breathe, the fish opens … and lets some water in.
   a) its gills
   b) its eyes
   c) its mouth

3. Tell true or false:

1) People get oxygen from the air, using their lungs.
2) Oxygen in the lungs passes through the skin.
3) Instead of lungs, the fish has special parts called gills.
4) Most fish would breath if you took them out of water.

4. Write a plan to retell the text.

UNIT IX

Aloe Vera

What exactly is Aloe Vera? Offciially it is recognised by botanists as a 'succulent' belonging to the lily family of flowering plants which also includes onions and garlic. However, Aloe is itself classified as a sub-species which includes around 300 plants. A small minority of the Aloe family are poisonous but the majority are completely non-toxic. Four specifically identified Aloes are known to contain medicinal benefits. Of these four plants one, Aloe Barbadensis Miller, is especially blessed with medicinal properties.

Over the centuries the Aloe has spread its way across the world finding root wherever there is a warm, arid environment. Aloe does not grow well in temperate latitudes and is rarely found in cold or wet regions. These plants prefer hot, dry, desert-like conditions. The Aloe's greatest enemy is frost.

The Ancient Egyptians knew about Aloe's amazing healing powers. Just over a hundred years ago a German Egyptologist called Ebers discovered an ancient papyrus dating from 3500 BC which listed twelve medicinal uses for the Aloe Vera plant. The Romans and Ancient Greeks also viewed Aloe as a 'miracle plant'. Records show that Alexander the Great used the extraordinary healing powers of Aloe Vera to help heal the battle wounds of his army. Records from ancient China, India and Babylon also describe the healing properties of this extraordinary plant.

Although many ancient cultures describe Aloe's amazing curative properties, it was not until the 1850s that modern science showed any interest in the plants properties and potential medicinal uses. Since then, scientists and physicians have continued to study Aloe in great depth. As a result, new applications for its curative properties are still being discovered. The medical and beauty industries today view Aloe Vera as a truly organic and natural product that simply helps improve wellbeing. As a result, Aloe Vera is an essential ingredient to many shampoos, toothpastes, deodorants, skin care products, slimming supplements, fitness foods, cosmetics and drinks. Many people claim that using Aloe Vera significantly improves their overall health, vitality and

fitness. In particular, Aloe Vera helps relieve digestive problems and skin disorders naturally where other manufactured drugs often fail.

But take care to read the label of health products carefully if you want to gain the true benefits of Aloe Vera for yourself! Many products use Aloe as a way to promote their health-giving goodness. But quite a few of these use quantities of Aloe that are too small to make any difference to the user. Aloe- based products that you can rely on are certified by the 'International Aloe Science Council'. This organisation's seal of approval on a label means you are buying the real thing.

So where do the amazing medicinal properties of Aloe Vera come from? The answer lies inside the fleshy leaves where the plant secretes and stores a mixture of gel and sap. The outer skin of the leaves has little value. But the gel inside contains some 75 natural ingredients that provide almost all the essential nutrients and minerals required by a healthy human body. The Aloe sap also has incredible restorative effects on human skin. Aloe sap protects skin again sun burn (because it helps block out ultraviolet light), many toxins and, by providing a non-toxic balm, helps promote rapid new cell growth in the skin to aid recovery from cuts, burns and abrasions.

benefit / ' benıfıt / користь
latitude / ' lætıtju:d / *геогр.* широта
curative / ' kjuərətıv / лікувальний
restorative / rı'stɔ:rətıv / *мед.* що відновлює
abrasion / ə 'breıʒn / садно

1. Answer the questions:

1) What is Aloe Vera?
2) Where has Aloe spread its way across the world?
3) Who used the extraordinary healing powers of Aloe Vera to help heal the battle wounds of his army?
4) To what is Aloe Vera an essential ingredient?
5) Where do the amazing medicinal properties of Aloe Vera come from?

2. Choose the wright variant:

1) Aloe Vera is recognised by botanists as a 'succulent' belonging to the lily family of flowering plants which also includes … .
   a) onions and garlic
   b) lichen and garlic
   c) onions and herb
2) Aloe Vera helps relieve ... .
   a) digestive problems and breathing
   b) digestive problems and skin disorders
   c) psychological problems
3) The Aloe sap has incredible restorative effects on … .
   a) human mind
   b) human life
   c) human skin

3. Tell true or false:

1) Aloe is itself classified as a sub-species which includes around 500 plants.
2) The Aloe's greatest enemy is water.
3) The Romans and Ancient Greeks viewed Aloe as a 'miracle plant'.
4) Aloe sap protects skin again sun burn.

4. Write a plan to retell the text.

UNIT X

The Magic of Trees

Trees are universally special. Wood is one of the most versatile natural products in the world with a vast array of different uses. Whether growing in natural rain forests or harvested by foresters, trees are a critical part of our lives. Indeed, trees are essential to our survival because they convert the greenhouse gas carbon dioxide into oxygen. As we enter a period of global warming, the fate of the world's forests could affect the future of us all.

Trees also provide habitats and shelter for wildlife while producing a wide range of foods vital to the survival and wellbeing of thousands of species. Moreover, trees have an aesthetic quality and natural beauty which speaks across the centuries to inspire artists from every culture. Our fascination for trees dates back to the beginning of time. There are a wealth of ancient stories from across the world telling of the 'magic qualities' of trees. Here are a few of the stories, legends and beliefs relating to trees.

Apple is a dense, fine-grained, rosy-coloured wood with a slightly sweet smell. Apples rank alongside olives and vines as the earliest trees cultivated by man. In Norse myth 'Idunna' was the keeper of the 'apples of immortality' which kept the gods young. And there is no doubt that apples are good for our health as suggested by the English saying "an apple a day keeps the doctor away." Not so long ago pupils could give an apple to their teacher as a way of giving thanks for their instruction. This may link back to the myth of Paris giving a golden apple to Aphrodite to show that she won his admiration as the most beautiful of the three most important goddesses of ancient Greece.

Ash is a strong, straight-grained wood that sometimes has 'olive' streaks or stripes in the grain. Nordic myths identify the European variety as 'Yggdrasil' or the 'World-Tree.' The ancient people of several parts of Europe used ash – or holly – to make spears because of its 'springiness' and straight grain. Many of the native peoples of North America split strips of black ash along the grain to make splints for baskets and hoops.

Birch is a lovely pale, fine-grained wood. Many north European cultures associate birch with fertility and healing. In parts of Russia

birch twigs decorate the homes of newlyweds – and the stalls of cattle that farmers hope will breed well! Birch is a traditional material in children's cradles. Birch is incredibly useful. Nearly every part of the tree is edible. Birch sap provided an important source of sugar to Native Americans and the early colonists of North America. The inner bark provides a pain reliever while the leaves help treat arthritis. Birch bark is light, durable and water resistant – perfect for cups, paper, canoe hulls, axe handles and even old-fashioned school canes. It is from this last application that English derives the phrase "a sound birching" to indicate a whipping which is meant to do a miscreant good!

ash / æʃ / ясен
streak / ' stri:k / прожилок
splint / ' splınt / лубок
birch / ' bə:tʃ / береза
newlywed / ' nju:lıvəd / молоді
axe / æks / сокира

1. Answer the questions:

1) What is wood?
2) What is the functions of the trees?
3) What can you say about apple?
4) What can you say about ash?
5) What can you say about birch?

2. Choose the wright variant:

1) Pupils could give an apple to ... as a way of giving thanks for their instruction.
   a) their doctor
   b) their driver
   c) their teacher
2) The ancient people of several parts of Europe used ash … .
   a) to make cups
   b) to make spears
   c) to make pots

3) Birch sap provided an important source of ... to Native Americans and the early colonists of North America.
   a) sugar
   b) water
   c) oil

3. Tell true or false:

1) Trees produce a wide range of foods vital to the survival and wellbeing of thousands of species.
2) Many of the native peoples of North America split strips of black ash along the grain to make splints for boats.
3) Birch is a traditional material in children's cradles.
4) Birch bark is heavy and brittle.

4. Write a plan to retell the text.

UNIT XI

Wallflowers

Let us exemine some young wallflower plants. You will notice immediately that the plant has two distinct parts – the root system which is not green and has no leaves and the shoot system which is composed of green leaves and stems.

The root system of wallflowers consists of a main or tap root which grows more or less vertically downwards with several lateral roots growing out from it. If you use a hand lens you will see that each lateral root issues from a slit in the tap root where it has burst its way out; also they are arranged in four rows. Much smaller roots growing in all directions branch from the lateral roots. It is very unlikely that you will be able to see any root hairs growing out near the tips of the finest roots because these are usually broken When the plant is dug up. If you want to see what these hairs look like, sow a few mustard or cress seeds on damp blotting-paper and keep them in a moist atmosphere for a few days. They will soon germinate and part of the roots will be covered with a white furry mass of root hairs unobscured by soil.

The root hairs are important because they absorb water and dissolve substances from the soil. Another important job of the root system is to anchor the plant.

The main stem and leaves will be obvious to everyone. Examine the leaves, starting from the bottom of the main stem and working up. Evidently the lowest leaves are the oldest for they are dying and losing their dark green colour, but the upper leaves are fresh and green. If the plant is not too young there will be leaf scars right at the base of the main stem where old leaves have fallen off.

Now trace the leaves right to the uppermost tip of the main stem where they become so small that you will not distinguish them. Apparently new leaves are constantly produced from the stem tip which is called a growing point. If the main stem ends in a series of flowers, look at one of the branches of the main stem to see a growing point surrounded by its cluster of tiny leaves.

Next notice on the young part of the main stem the ridges running down from the points where the leaves are attached. How many ridges are there at any one point on the stem? Cut across the

stem with a razor blade to check your answer. You will understand the arrangement of the leaves best if you draw an imaginary line up the stem passing through the point where each leaf is attached. It is a spiral line and so we say the leaves are spirally arranged.

What do you notice in the angle between a leaf and a stem? There is either a small bud or a recognizable stem with leaves, i. e. a lateral branch of the main stem. You will see that buds do not arise anywhere on the stem but just above the point of leaf attachment, or in the axil of a leaf. Not all buds are able to grow into new branches because the plant never has enough food; some always remain dormant and small.

wallflower / ˌwɔ:l' flauə / желтофіоль садова
germinate / 'dʒəmɪneɪt / прорастати
scar /skɑ: / рубець
growing point / 'grouɪŋ ' pɔɪnt / точка росту
cluster / ' klʌstə / пучок
ridges / 'rɪdʒɪz / рубчики
axil / 'æksɪl / пазуха
dormant /' dɔ:mənt / дрімаючий

1. Answer the questions:

1) What are two distinct parts of the plant?
2) From what does the root system of wallflowers consist?
3) Why are the root hairs important?
4) What leaves are the oldest?
5) How many ridges are there at any one point on the stem?

2. Choose the wright variant:

1) The root system of wallflowers consists of … .
   a) a main or tap root
   b) a main or tap root with several lateral roots
   c) several lateral roots
2) The root hairs are important because they... .
   a) absorb water and dissolve substances from the soil
   b) liberate water and different substances
   c) absorb sunlight

3) New leaves are constantly produced from the stem tip which is called… .
   a) a growing point
   b) a scar
   c) a ridge

3. Tell true or false:

1) Each lateral root issues from a slit in the cluster.
2) The root system anchors the plant.
3) New leaves are constantly produced from the stem tip which is called the axil.
4) Buds do not arise anywhere on the stem but just above the point of leaf attachment, or in the axil of a leaf.

4. Write a plan to retell the text.

CHEMISTRY

UNIT I

Philosophy of Early Chemists

Gold has always held an unusual fascination for people throughout the ages. The belief that the gold could be made by transmutation of other metals such as lead and mercury originated in part from the teaching of Aristotle who believed that all things tend to reach state of perfection and all metals could be changed into gold, the most perfect of all metals. It was man's great desire for gold and his belief that it could be made artificially that stimulated alchemists' continual search for the philosopher's stone. Alchemists were divided into two groups with opposing moral values: those who actually believed in the existence of philosopher's stone and honestly strove to discover it, and those more scurrilous individuals who falsely claimed to be able to transmute metals into gold but in reality were only frauds seeking to deceive the nobility. An alchemist could easily demonstrate apparent transmutation of metals by placing an iron into a coppcr sulphate solution. Although the nail was only coated with copper, the deception may not have been readily recognised.

There were many tricks which alchemists used to give the illusion of successful transmutation to gold. Michael Senivogius (1566-1646) managed to defraud many wealthy people by coating gold coins with mercury and then causing it to evaporate away to give the impression that silver had converted into gold.

Actually at that time, every man who tried to study secrets of nature was thought to be a magnician. People believed that Albertus Magnus, a very famous alchemist of his time, could change course of the seasons. They said that Albertus Magnus wanted to build a monastery not far from Cologne, but the Prince refused to sell him the land. So, Albert invited the Prince and his court to come to the very special entertainment that he organised at his house in their honour. The Rhein was frozen and the winter was very severe then. The Prince and his knights were almost frozen to death when they finally came to Magnus house. Great was their surprise when they saw a repast spread

in the garden, the garden that was filled with songs of beautiful birds and the shining sun. The trees began to cover with fresh green leaves, and it was very warm. The Prince was fascinated with all those wonders and agreed to give the land to the great magician.

During the early Renaissance some began to challenge Aristotelian theories and attempted to explain many chemical reactions in atomic terms. For instance, it was realised that the replacement of iron by copper in a copper sulphate solution was not really transmutation. It was only the exchange of atoms. Pierre Gassendi (1592-1655) was an anti-Aristotelian who believed in the existence of atoms, but he thought that their size and shape could account for all the properties of matter. Nicolas Lemary (1645-1715) used similar ideas to explain physical and chemical properties of subsiances. Lemary claimed that acids had sharp spikes on their atoms which accounted for the pricking sensation they exert on the skin.

Through careful scientific observation van Helmont made several important contributions to the development of early chemistry, including studies with carbon dioxide, the discovery of hydrogen sulfide in the human intestine and the presence of an acidic fluid in stomach.Nevertheless, he still retained a belief in the possibility of transmutation.

Many scientists believed in transmutation, among them Roger Bacon, Robert Boyle and even Isaac Newton.

unusual fascination / ʌn'ju:ʒuəl fəsı 'neıʃn / незвичайне хвилювання
continual search / kən'tınjuəl 'sə:tʃ / постійний пошук
moral value / 'mɔrəl 'vælju: / моралтна цінність
transmutation / 'trænzmju: 'teıʃn / перетворення
sharp spik / 'ʃa:p 'spaık / різке зростання
scientific observation / saıən'tıfık ˌɔbzə:'veıʃn / наукове спостереження
important contribution / ım'pɔ:tənt kəntrı'bju:ʃn / важливий внесок

1. Answer the questions:

1) Where did the belief that the gold could be made by transmutation of other metals originate?
2) What stimulated alchemists' continual search for the philosopher's stone?

3) How could alchemists easily demonstrate the apparent transmutation of metals?
4) How did Michael Senivogious defraud people?
5) What contributions did van Helmont make?

2. Choose the wright variant:

1) Michael Senivogius managed to defraud many wealthy people by coating gold coins with mercury and then causing it to evaporate away to give the impression that … .
   a) silver had converted into gold
   b) gold had converted into silver
   c) silver had converted into water
2) At that time every man who tried to study secrets of nature was thought to be ... .
   a) the Prince
   b) a doctor
   c) a magnician
3) During the early Renaissance it was realised that the replacement of iron by copper in a copper sulphate solution was … .
   a) really transmutation
   b) only the exchange of atoms
   c) only the exchange of molecules

3. Tell true or false:

1) Alchemists were divided into two groups: those who actually believed in the existence of philosopher's stone and honestly strove to discover it, and those who falsely claimed to be able to transmute metals into gold but in reality were only frauds seeking to deceive the nobility.
2) The Prince and his knights were surprised when they came to Magnus house and saw that the garden was filled with songs of beautiful birds and the shining sun.
3) Lemary claimed that alkali metals had sharp spikes on their atoms which accounted for the pricking sensation they exert on the skin.
4) Van Helmont made several important contributions to the development of early chemistry, including studies with carbon dioxide and the presence of an acidic fluid in stomach.

4. Write a plan to retell the text.

UNIT II

Chemical Reactions and Equations

From the chemistry point of view chemical reaction is a process by which one or more chemical substances are converted into one or more new substances. Reactants (or starting materials) converted into products (new materials). One of the most important effects of reaction is the energy that is educing (or merging) during it. An educing-energy reaction is called exothermic and a reaction that absorbs energy is an endothermic one.

Almost all reactions can be classified into four major types: combinative, decompositive, single replacement, double replacement.

The rate of every reaction is different and the study of reaction rate is called kinetics. The rate of reaction depends on concentrations of reactants, the temperature and other factors. The mole concept will help us to calculate the amount of products and reactants, but first we must learn how chemists represent chemical reactions by chemical equations.

You are familiar with chemical symbols (letters) and chemical formulas (words). To describe chemical reactions, we'll use chemical equations (sentences), which are shorter descriptions than sentences, but chemical equation contains much more information than the sentence does.

Usually, chemical equations have the form:

Reactants	=>	Products
starting materials		final materials

We can translate a sentence that describes a chemical reaction into an equation that describes the same reaction by:

1. Writing correct formulas that correspond to the names of chemical substances mentioned.
2. Deciding which formulas are reactants and which products.
3. Following the preceding format, writing reactant formulas to the left and product – to the right.

There is another step required to write a correct chemical equation. One must be balanced that means that on both sides of the arrow there is the same number of atoms of each kind. An equation

must be balanced in order to satisfy the Law of Conservation of Matter, which states that «the matter can neither be created nor destroyed in chemical reaction». Chemical reactions are «rearrangements» or «reshuffling» of atoms, but no new atoms are formed, nor old ones are lost.

A chemist should balance equation by inserting coefficients and must not alter subscripts.

starting material / 'sta:tıŋ mə'tıərıəl / вихідна сировина
amount of product / ə' maunt əv 'prɔdəkt / кількість продукту
a great deal / ə 'greıt 'di:l / багато
useful information / 'ju:sful ınfə 'meıʃn / корисна інформація
in order to / ın 'ɔ:də tu / для того, щоб
correct formula / kə'rekt 'fɔ:mjulə / правильна формула

1. Answer the questions:

1) What is a chemical reaction?
2) What reaction is called exothermic?
3) What types can all chemical reactions be classified in?
4) How do we usually describe chemical reactions?
5) What does the law of Conservation of Matter state?

2. Choose the wright variant:

1) A reaction that ... energy is an endothermic one.
   a) absorbs
   b) liberates
   c) stops
2) The … depends on concentrations of reactants, the temperature and other factors.
   a) colour of energy
   b) rate of reaction
   c) rate of energy
3) Chemical equations are ... descriptions than sentences, but chemical equation contains much more information than the sentence does.
   a) greater
   b) longer
   c) shorter

3. Tell true or false:

1) The rate of every reaction is different and the study of reaction rate is called kinetics.
2) One of the most important effects of reaction is the energy that is educing during it.
3) Almost all reactions can be classified into three major types: combinative, decompositive, double replacement.
4) The mole concept will help us to calculate the rate of products and reactants.

4. Write a plan to retell the text.

UNIT III

The Elements Selenium and Tellurium

Selenium and tellurium which we know to belong to the sixth group of elements are closely related.

Selenium is widely distributed over the earth surface, but in total amount it is about equal to that of gold and bromine. Tellurium is estimated to be about one half as abundant as selenium. Usually these elements are classed among the rare elements. But from the point of view of industry they are readily available since they occur in what one knows to be called the sulphide ores of copper, silver, gold and nickel. In the refining of these ores it is essential that selenium be removed. Because of their abundance these elements could be produced in moderately large quantities were there sufficient commercial demand.

By showing these two elements to possess a number of allotropic forms, one can prove them to resemble sulphur, the forms of selenium having been extensively studied. They are: 1) two varieties which we find to dissolve in carbon disulphide from which they crystallize out in red monoclinic forms; 2) metallic selenium, steel grey in colour. It is this form of selenium which is known to have unusual properties of electrical conductivity; 3) amorphous selenium which is really found to be supercooled liquid of great viscosity.

Tellurium is both amorphous and crystalline. Crystalline tellurium is so brittle that it is easily ground to powder.

It should be noted that the metallic properties of the elements of the sulphur family to which we know selenium and tellurium to belong increase with the atomic weight, tellurium being the most metal-like of the four elements.

Grey selenium has a low electrical resistivity. This ability to conduct electricity, which we consider to represent a special characteristic property of grey selenium, changes with exposure to light, varying directly with the degree of illumination. It is this photoelectric property that is responsible for the use of selenium in photoelectric cells.

Both selenium and tellurium are alike in being monatomic at 2,000°. In their chemical behaviour we find them to resemble sulphur in uniting with many metals and forming selenides and tellurides.

They burn in air, forming dioxides and after further oxidation they give trioxides.

In order to prepare hydrates of selenium and tellurium one may apply methods which are known to resemble those used for the preparation of hydrogen sulphide, viz. (namely) the direct union of the element and the reaction of acids with binary metal compounds.

selenium / sɪ'li:njəm / селен
tellurium / te'ljuərɪəm / телур
distribute / dɪs'trɪbju:t / розповсюджувати
variety / və'raɪətɪ / різноманітність
resistivity / rezɪs'tɪvɪtɪ / питомий опір
binary / 'banərɪ / бінарний

1. Answer the questions:

1) What group do selenium and tellurium belong to?
2) Are these elements classed among the rare elements?
3) What are the forms of selenium?
4) What is the crystalline tellurium?
5) What are the properties of grey selenium?

2. Choose the wright variant:

1) Tellurium is estimated to be about one half as abundant as … .
   a) oxygen
   b) selenium
   c) carbon
2) Metallic selenium is ... in colour.
   a) steel grey
   b) red
   c) greenish
3) ... changes with exposure to light, varying directly with the degree of illumination.
   a) tellurium
   b) crystalline tellurium
   c) grey selenium

3. Tell true or false:

1) Selenium and tellurium which we know to belong to the fifth group of elements are not closely related.
2) Because of their abundance these elements could be produced in moderately large quantities were there sufficient commercial demand.
3) Grey selenium is so brittle that it is easily ground to powder.
4) Selenium and tellurium burn in air, forming dioxides and after further oxidation they give trioxides.

4. Write a plan to retell the text.

UNIT IV

Etymology of Polymers

Modern textbooks of polymer chemistry explain that the word «polymer» is derived from the Greek words «poly», meaning many, and «meros», meaning part. They often then infer that logically this term applies to giant molecules built up of large numbers of interconnected monomer units. However, the term polymer has not always had this meaning.

The word «polymer» was introduced into chemistry by the Swedish chemist J. Berzelini (1779-1848). In 1832 he put forward a definition of the word polymer which, as originally applied, described the situation in which molecules had identical empirical formulae but different chemical and physical properties.

Later this definition underwent a subtle modification as shown by Holleman who, in his

Textbook of Organic Chemistry published in 1920, defined polymerisation as the union of two or more molecules of a substance to form a body from which the original compound can be regenerated. A polymer, then, was the substance that resulted from such a union.

Thus the word polymer is to be found in textbooks of organic chemistry published up to about 1920 but not with its modern meaning.

Uncertainty about the nature of polymers did not arise only from imprecise and shifting definitions. There was the additional difficulty from the emerging science of colloids, which had effectivly begun with the studies of Thomas Graham (1805-1869).

For some years afterwards the terms colloid and polymer were used interchangeably and thus polymers were considered to be nothing more than colloids – aggregates of small molecules held together by ill-defined secondary forces.

Hermann Staudinger (1881-1965) was particularly impressed by Harries ideas of chemical and physical molecules. By about 1930 Staudinger and others had accumulated much evidence in favour of the macromolecular hypothesis. The final part in establishing the concept was done by Wallace Carothers (1896-1937).

As a result of Carothers' work, the idea implied by Pickles and championed so vigorously by Staudinger, that polymers consist of macromolecules, became widely accepted. The concept of macromolecules has now been so successful at explaining the properties of polymers, that later generations of chemists can hardly imagine how revolutionary the idea once seemed. Now that the dimensions of polymer molecules have been measured by so many different techniques, there can be no doubt that these giant molecules really do exist. Those pioneering chemists, Staudinger and Carothers, were the first to realise the truth about the size of polymer molecules, and the subsequent development of polymer science has shown that they were right.

polymer / 'pɔlımə / полімер
introduce / ıntrə'dju:s / впроваджувати
definition / defı'nıʃən / визначення
interchangeably / ˌıntə:'tʃeındʒəblı / взаємозамінно
macromolecule /ˌ mækrɔu 'mɔlıkju:l / макромолекула

1. Answer the questions:

1) From what is the word «polymer» derived?
2) By whom was the word «polymer» introduced into chemistry?
3) Why were the terms colloid and polymer used interchangeably for some years?
4) By what time had Staudinger and others accumulated much evidence in favour of the macromolecular hypothesis?
5) What was a result of Carothers' work?

2. Choose the wright variant:

1) In 1832 the Swedish chemist J. Berzelini put forward a definition of the word … .
   a) macromolecule
   b) polymer
   c) substance
2) Holleman defined polymerisation as the union of two or more … of a substance to form a body from which the original compound can be regenerated.
   a) molecules

b) elements
c) atoms

3) Staudinger and ... were the first to realise the truth about the size of polymer molecules.
   a) Berzelini
   b) Graham
   c) Carothers

3.Tell true or false:

1) Greek word «meros» means many.
2) Thus the word polymer is to be found in textbooks of organic chemistry published up to about 1920 with its modern meaning.
3) The Swedish chemist J. Berzelini was particularly impressed by Harries ideas of chemical and physical molecules.
4) The concept of macromolecules has now been so successful at explaining the properties of polymers, that later generations of chemists can hardly imagine how revolutionary the idea once seemed.

4. Write a plan to retell the text.

UNIT V

Monatomic Hydrogen

At high temperature hydrogen molecules are found to dissociate into atoms to some extent, but on account of large heat of dissociation (103.4 k. cals) the amount of atoms formed is very small, being at 1 atmosphere about 1 per cent at 2,000°K and about 9 per cent at 3,000°K.

The molecules can, however, be dissociated by other means at lower temperatures, and they are known to recombine relatively slowly (owing to the difficulty of getting rid of the heat of reaction) especially at low pressures, so that the gas can be more or less completely converted into single atoms, which are known to remain in that state rather long, so that their properties may be examined. This is known as “active” hydrogen, but it is likely to be the only active form existing. It can be prepared in various ways.

Langmuir has shown wires of tungsten, platinum, or palladium, heated to temperatures of from 1,000° to 2,000° C in hydrogen gas at pressures of 0.01 mm. or less to give rise to atomic hydrogen by absorbing H_2 and emitting H.

It was also found that if an electric discharge was passed through hydrogen at a fraction of millimetre pressure in very long tubes, the central part of the tube gave a pure Balmer spectrum, showing it to contain a large proportion of hydrogen atoms. Other investigators improved this method by using an inert carrier gas such as neon (e. g. 25 mm. neon and 1 mm. hydrogen); this enables hydrogen to be passed into liquid of higher vapour pressures.

It was shown that hydrogen with the same reducing properties could be obtained in larger yields and at higher pressures (up to 15 mm.) by mixing it with mercury vapour and exposing it to the resonance radiation (wave-length 2,537 A) of mercury arc.

k. cal – kilocalorie
°K – degree Kelvin
platinum / 'plætınəm / платина
palladium / pə'leıdıəm / паладій
millimetre / 'mılımi:tə / міліметр

mercury / 'mə:kjurı / ртуть
neon / 'ni:ən / неон
inert / ı'nə:t / інертний
cryolite / 'kraıoulaıt / кріоліт

1. Answer the questions:

1) What happens to hydrogen molecules at high temperature?
2) How can the molecules be dissociated by other means at lower temperatures?
3) What is known as “active” hydrogen?
4) What has Langmuir shown?
5) What was found if an electric discharge was passed through hydrogen at a fraction of millimetre pressure in very long tubes?

2. Choose the wright variant:

1) If an electric discharge was passed through hydrogen at a fraction of millimetre pressure in very long tubes, … of the tube gave a pure Balmer spectrum.
   a) the central part
   b) the left part
   c) the right part
2) Some investigators use an inert carrier gas such as ... ; this enables hydrogen to be passed into liquid of higher vapour pressures.
   a) argon
   b) nitrogen
   c) neon
3) Hydrogen with the same reducing properties could be obtained in larger yields and at … pressures by mixing it with ... vapour and exposing it to the resonance radiation of mercury arc.
   a) lower, mercury
   b) higher, mercury
   c) higher, neon

3. Tell true or false:

1) At high temperature hydrogen molecules are found to dissociate into atoms to some extent, but on account of large heat of dissociation the amount of atoms formed is very high.

2) Langmuir has shown wires of tungsten, platinum, or palladium, heated to temperatures of from 1,000° to 2,000° C in hydrogen gas at pressures of 0.01 mm. or less.
3) If an electric discharge was passed through hydrogen at a fraction of millimetre pressure in very long tubes, the central part of the tube gave a pure Balmer spectrum, showing it to contain a large proportion of hydrogen atoms.
4) Using neon enables hydrogen to be passed into solid of higher vapour pressures.

4. Write a plan to retell the text.

UNIT VI

The Background of Halogen Family

Hallogens are very reactive elements that exist under normal conditions as diatomic molecules with covalent bonds. These molecules are all coloured. Gaseous fluorine is pale yellow; gaseous **ilil** chlorine is yellow-green; gaseous bromine is orange-red; and gaseous iodine is violet. The halogens are all toxic and dangerous substances. Fluorine F , is the most hazardous. All fluorides must be handled carefully. A mixture of hydrogen and fluorine has been studied for possible use as a rocket fuel. A variety of useful compounds contain fluorine. Some communities add fluorides to their water supply to stop tooth decay. Compounds of fluorine with carbon and hydrogen, known as Freons and Teflons, have many uses. Freons are used as refrigerants. Teflons are resistant to corrosive chemicals.

Chlorine is a gas of great importance. Because of its pronounced activity as a non-metal and its tendency to combine with metals, chlorine is never found naturally in a free state. Chlorine has many uses. It is added to drinking water and swimming pools to kill bacteria. If you want to bleach your clothing, you use a strong chlorine compound known as sodium hypochlorite. Too much chlorine can kill. In war times it is used in poison gases to destroy lives. It is also used in the manufacture of dyes, explosives, in extracting gold from its ores.

Bromine was discovered in 1826 by a French chemist Balard. Bromine is liquid at room temperature. The liquid itself is extremely caustic and if spilled on the skin will produce severe burns. An important use of bromine today is in the manufacture of anti-knock gasoline. Another use is in medicine. Compounds containing bromine are used as sedatives.

Iodine is the most gentle member of the halogen family. It is found in ocean water and in certain kinds of seaweed.

In small amounts iodine is essential to human life. It is added to common table salt. To the average person iodine is known in the form of the tincture, used as an antiseptic.

Astatine was not discovered until 1940. It is a very rare element. It is very unstable and radioactive. Compounds containing astatine are not commercially useful.

All of the halogen elements are poisonous and corrosive. Use extreme caution in handling them. Do not breathe the vapours given off by these elements.

gallogen / 'hæləʤən / галоген
fluorine / 'fluəri:n / флуор
bromine / 'broumi:n / бром
iodine / 'aɪədi:n / іод

1. Answer the questions:

1) What happens to the colours of the halogen elements as you go down the halogen family (from fluorine to iodine)?
2) What happens to the boiling points as you go down the halogen family?
3) In what ways are these elements alike?
4) In what ways are they different?
5) Are all of the halogen elements poisonous and corrosive?

2. Choose the wright variant:

1) A mixture of ... and fluorine has been studied for possible use as a rocket fuel.
   a) hydrogen
   b) oxygen
   c) carbon
2) Some communities add fluorides to their water supply … .
   a) to boil it
   b) to cool it
   c) to stop tooth decay
3) Chlorine is added to ... to kill bacteria.
   a) drinking water
   b) food
   c) hydrogen

3. Tell true or false:

1) Bromine was discovered in 1826 by a German chemist Balard.
2) An important use of bromine today is in the manufacture of anti-knock gasoline.
3) Iodine is the most gentle member of the halogen family.
4) Astatine is very stable and radioactive.

4. Write a plan to retell the text.

UNIT VII

Chlorine

Because of its pronounced activity as a non-metal and its consequent tendency to combine with metals, chlorine is never found naturally in a free state. In the combined state, however, it is assumed to be one of the moderately abundant elements of the earth's crust. Chemists consider its most abundant natural compounds to be the chlorides of certain metals. Of these, sodium chloride is estimated to be by far the most abundant.

Experiments showed chlorine to be only slightly soluble in water. Its density is stated to be almost two and one-half times that of the air, a litre under normal conditions weighing about 3.2140 grams.

We know chlorine to be a typical non-metal. As such it resembles oxygen in some respects, but differs in showing more pronounced activity in its reactions with metallic elements. Oxygen, on the other hand, is found to display a somewhat greater tendency to react with non-metals.

Absolutely dry chlorine does not seem to attack metals; at least the reaction is extremely slow. Experiments prove chlorine to react with almost all of the non-metals. The reaction of hydrogen and chlorine is exothermic.

$$H_2 + Cl_2 = 2\ HC1 + 44000\ cal.$$

We should expect, therefore, these two elements to combine very readily and the product to be very stable. In the dark, however, hydrogen does not appear to combine with chlorine with appreciable velocity and reaction seems to require the presence of a catalyst. In ordinary light the reaction is likely to take place slowly. But if the mixture were exposed to direct sunlight we could see the reaction occur violently.

Since chlorine combines very readily with free hydrogen, we should expect it also to react with compounds containing hydrogen. This is really the case. Natural gas, for instance, which is known to consist largely of methane (CH_4) continues to burn when a lighted jet of the gas is introduced into a cylinder filled with chlorine, hydrogen chlorine and free carbon being produced. In bright sunlight a mixture of methane and chlorine reacts more slowly, and the reaction occurs in steps[3] in which chlorine both combines with and replaces hydrogen.

With certain compounds, chlorine is stated to combine directly to form what are called addition compounds. Besides, chlorine may also be shown to react with compounds with certain chlorides in much the same manner as oxygen reacts with certain oxides. These reactions show chlorine to play its most characteristic role, that of a vigorous oxidizing agent.

chlorine / 'klɔ:ri:n / хлор
tendency / 'tendənsı / тенденція
litre / ' lıtə / літр
catalyst / ' kætəlıst / каталізатор
methane / 'meθeın / метан
by far – значно

1. Answer the questions:

1) Why is chlorine never found in a free state?
2) What are the most abundant natural compounds of chlorine?
3) What are the properties of chlorine?
4) In what respects does chlorine differ from oxygen?
5) What elements does chlorine react with?
6) What kind of agent is chlorine?

2. Choose the wright variant:

1) Sodium chloride is estimated to be … .
   a) the most abundant
   b) the most expensive
   c) the lightest
2) The reaction of ... and chlorine is exothermic.
   a) hydrogen
   b) oxygen
   c) neon
3) Chlorine may react with compounds with certain chlorides in much the same manner as ... reacts with certain oxides.
   a) lithium
   b) hydrogen
   c) oxygen

3. Tell true or false:

1) Chlorine is found in a free state in nature.
2) Chlorine is a typical non-metal.
3) Chlorine reacts with compounds containing hydrogen.
4) Absolutely dry chlorine attacks metals readily.

4. Write a plan to retell the text.

UNIT VIII

Factors that Influence Reaction Rate

It is often very important to know under what conditions will two substances react sufficiently rapidly for the reaction to be of practical use. Therefore, when making experiments, account is to be taken of the factors that influence the rate of the reaction. Attention should be paid to the fact that the reaction rate is affected by temperature, concentration, catalysts and so on. Let us consider these factors.

Temperature. In general the speed of a reaction increases two or four times for a rise of 10° in the temperature of the substances involved in the reaction. The effect of the change of temperature can be readily understood from the kinetic molecular point of view. The velocities of the molecules are increased as the temperature rises. Faster moving molecules meet oftener and being of higher energy content are more likely to react on meeting. Hence the rise of temperature gives more opportunity for the molecules to react and results in the production of larger quantities of the products of the reaction in the same period of time.

Concentration. Concentration means the amount of a substance in unit volume. The effect of increased concentration upon the speed of reaction does not seem to be difficult to understand. Naturally, the more molecules of a reacting substance in a given volume, the greater will be the number of chances for these molecules to react with the molecules of another substance in the same space. In other words, we may say: for the reaction to take place, an A molecule must first meet a B molecule, the chances of their meeting being proportional to the concentration of each.

Catalysts. A catalyst is a substance which makes a reaction proceed more quickly or more slowly than would happen were the catalyst absent. The presence of a catalyst is not sufficient for the reaction to be started, it is needed for the reaction velocity to be changed.

We find some catalysts to be useful, because they retard certain reactions, but most of the catalysts used commercially are valuable because they accelerate reactions that otherwise would be too slow to

use. The use of a catalyst is frequently of considerable importance in the manufacturing industries, because it allows a greater quantity of the products of a reaction to be manufactured in a given period of time.

molecular / mɔ'lekjulə / молекулярний
proportional / prə'pɔ:ʃənə1 / пропорційний
nickel / 'nɪkl / нікель
valuable / 'væljuəbl / цінний
otherwise / 'ʌðəwaɪz / в іншому випадку

1. Answer the questions:

1) What is the reaction rate affected by?
2) What is the concentration?
3) What is a catalyst?
4) Do catalysts only accelerate reactions?
5) Why is the use of a catalyst of great importance in the manufacturing industries?

2. Choose the wright variant:

1) The ... of a reaction increases two or four times for a rise of 10° in the temperature of the substances involved in the reaction.
   a) speed
   b) time
   c) height
2) The more molecules of a reacting substance in a given volume, … will be the number of chances for these molecules to react with the molecules of another substance in the same space.
   a) the less
   b) the rapider
   c) the greater
3) The presence of a catalyst is not sufficient for the reaction to be started, it is needed for the reaction ... to be changed.
   a) place
   b) velocity
   c) view

3. Tell true or false:

1) The velocities of the molecules are decreased as the temperature rises.
2) The rise of temperature gives more opportunity for the molecules to react.
3) A catalyst is a substance which makes a reaction proceed more quickly or more slowly than would happen were the catalyst absent.
4) The use of a catalyst is frequently of considerable importance in the manufacturing industries, because it allows a greater quantity of the products of a reaction to be manufactured in a given period of time.

4. Write a plan to retell the text.

UNIT IX

Radiation and Nuclear Chemistry

None of the naturally occurring elements with atomic numbers greater than 82 has any stable isotopes. All of them eventually decay into a stable isotope of lead. In addition to these radioactive isotopes that are found naturally, there are numerous radioactive isotopes of the other elements that can be produced by bombarding stable nuclei with high-energy particles, such as proton, alpha particles, and neutrons. For example, if the normally stable nuclei of beryllium are bombarded by protons (hydrogen nuclei), some of the beryllium nuclei are changed to lithium nuclei, and helium nuclei (alpha particles) are given off.

This reaction can be represented as follows:

$$H + Be \rightarrow Li + He$$

Note that this lithium nucleus is not the stable isotope found in nature (Li), but the unstable, or radioactive, isotope of mass number 6. Thus, a radioactive isotope of lithium has been produced from a stable isotope of beryllium. Since both a proton and a beryllium nucleus have positive charges, they repel each other. The proton must therefore have a high kinetic energy in order to overcome the repulsive forces and collide with, or interact with the beryllium nucleus. This is true of all bombardments of nuclei with protons and alpha particles, which are positivly charged. These particles are given sufficient energy by being injected into a particle accelerator.

There are various types of accelerators, but they all use electric and magnetic forces to gradually increase the speed of the particles before directing them toward the target material.

Any change in the nucleus of an atom that converts it from one element to another is called transmutation when the change is brought about by bombarding the nucleus with high energy particles, the process is called artificial transmutation.

In nuclear equations, the symbols represent atomic nuclei. The superscript indicates the mass number and the subscript indicates the atomic number (number of protons). When writing equations, it is necessary that the sum of the mass numbers of the reactants be equal to the sum of the mass numbers of the products. In a nuclear reaction,

if all but one of the elements of the reaction are known, the unknown element can be predicted usnig mass numbers and atomic numbers.

In nuclear reactions, mass is converted to energy. There are two basic types of nuclear reaction – fission and fusion. Fission reactions involve the «splitting» of a heavy nucleus to produce lighter nuclei. Fusion reactions involve the combining of light nuclei to produce a heavy nucleus. In both types of reaction, the total nuclear mass of the product is less than the total nuclear mass of the rectant. In other words, nuclear reactions involve some «loss» of mass. In reality, this mass is not lost; it is converted to energy. Nuclear reactions involve energies much greater than those found in ordinary chemical reactions.

stable isotope / 'steɪbl 'aɪso(u)toup / стійкий ізотоп
high-energy particles / ˌhaɪ 'enədʒɪ 'pa:tɪklz / частинки високих енергій
kinetic energy / kaɪ'netik 'enədʒɪ / кінетична енергія
repulsive force / rə'pʌlsɪv 'fɔ:s / сила відштовхування
particle accelerator / 'pa:tɪkl æk'seləreɪtə / прискорювач частинок
magnetic force / mæg'netɪk 'fɔ:s / магнітна сила
artificial transmutation / ˌaɪtɪ'fɪʃəl ˌtrænzmju(:)'teɪʃn / штучне перетворення

1. Answer the questions:

1) What naturally occurring elements with atomic numbers greater than 82 have any stable isotopes?
2) From what isotope was a radioactive isotope of lithium produced?
3) What is artificial transmutation?
4) What does a subscript indicate in nuclear equations?
5) What are two basic types of nuclear reaction?

2. Choose the wright variant:

1) If the normally stable nuclei of beryllium are bombarded by … (hydrogen nuclei), some of the beryllium nuclei are changed to lithium nuclei, and helium nuclei (alpha particles) are given off.
   a) neutrons
   b) protons
   c) elements

2) A radioactive isotope of lithium has been produced from a stable isotope of … .
   a) beryllium
   b) barium
   c) cadmium
3) In nuclear reactions mass is converted to … .
   a) energy
   b) rate
   c) time

3. Tell true or false:

1) All of the naturally occurring elements with atomic numbers greater than 93 eventually decay into a stable isotope of lead.
2) There are various types of accelerators, but they all use electric and magnetic forces to gradually increase the speed of the particles before directing them toward the target material.
3) Any change in the nucleus of a molecule that converts it from one element to another is called transmutation.
4) Nuclear reactions involve some «loss» of mass. In reality, this mass is not lost; it is converted to energy.

4. Write a plan to retell the text.

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