THE MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

KYIV NATIONAL UNIVERSITY
OF TECHNOLOGIES AND DESIGN

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ENGLISH FOR CHEMISTS

The educational textbook

Recommended by the Academic Council
of Kyiv National University of Technologies and Design
for the students of chemical and biopharmaceutical technology faculty,
course of study “English for specific purpose”

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The textbook English for Chemists is intended for the students – future specialists in the field of chemistry. This textbook provides an important opportunity for students to learn the core concepts of chemistry. At the same time, the textbook includes materials for the following areas of study as electrochemical power engineering and chemistry, industrial pharmacy, technology of polymers and chemical fibers, examintion of leather and fur.

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Part 1

Unit 1

EDUCATION IN OUR LIFE

Education plays a very important role in our life. It ensures a brighter future for everyone. Not many people succeed in life without a good educational foundation. Education is a national policy which is always given top priority. Almost all people want an interesting job with a good salary. To achieve it, you must get a good education. Getting a good job means having a better living standard. It helps us to meet challenges of life and see the world with greater understanding.

Education is the process of learning and knowing, which is not restricted to our school text-books. It is a holistic process and continues through our life. Even the regular happenings and events around us educate us, in one or the other way. It would not be an exaggeration to say that the existence of human beings is fruitless without education. An educated person has the ability to change the world.

The system of public education in our country is based on compulsory 11-year schooling for all citizens. The period of studies at higher school is generally 5 or 6 years. Most students who do well in their studies are paid state scholarships. Some universities have evening departments for those who combine work with studies.

There are many universities in our country. Kyiv National University of Technologies and Design is one of the oldest and largest higher technical schools. It was founded in 1930. Nowadays the University is a large scientific and educational centre of our country. Anybody who has got secondary education may enter the University. The Kyiv National University of Technologies and Design numbers more than 6000 students, 8 faculties, 32 departments (including the military department), 6 academic buildings, 7 hostels, sport complex, canteen, café, experimental workshops, etc. The University trains engineers in more than 20 specialties (some of them have up to 10 specializations) at full-time and extra-mural departments for Ukraine and other countries, as well as retraining and refresher courses. The teaching staff is highly qualified.

There are laboratories provided with up-to-date equipment where students carry out various experiments. The students have at their disposal a rich library and a large reading room. They carry out research work at different departments of the University and the results of their work often find practical application. The students have practical training at the plants of the country.

Sport plays an important part in the physical training of students. There are many sport sections where students go in for sports and there are many masters of sports among students of the University.

1. Words and word combinations to be remembered.

priority - пріорітет
living standard – рівень життя
achieve - досягати
holistic – холістичний, глобальний, цілісний
exaggeration - перебільшення
compulsory – обов'язковий
secondary education – середня освіта
scholarship - стипендія
workshop - майстерня
full-time and extra-mural departments – стаціонар і заочне відділення
retraining courses – курси перекваліфікації
refresher courses – курси підвищення кваліфікації
to have at one's disposal – мати в розпорядженні
practical application – практичне застосування

2. Answer the following questions.

1.Does education play a very important role in our life?
2.What is the period of studies at higher school in our country?
3.How many faculties are there at the University?
4.Are the students engaged in research work?
5.What is the teaching staff of the University?
6.What sport facilities are there at the University?
7.In how many specialties are the specialists trained at the University?
8.When was the University founded?
9.What do students have at their disposal at the University?
10.Where do students have practical training?

3. Match the words with their definitions.

1. Education	a) ability or proficiency
2. Knowledge	b) one who studies something
3. Student	c) the process of developing knowledge or skills
4. Graduate	d) a course of study in a school or college
5. Curriculum	e) faculty, a separate part or division
6. Department	f) one who has completed a course of study at school or college
7. Skill	g) range of information or understanding, what is known

3. Mark the following statements as true(T) or false(F).

1. There are many universities in our country.

2. Kyiv National University of technologies and design is a comparatively young.
3. The Kyiv National University of Technologies and Design numbers more than 10 faculties.
4. The laboratories are not provided with up-to-date equipment where students carry out various experiments.
5. The teaching staff is highly qualified.
6. The students have at their disposal a rich library.
7. The results of students' work often find practical application.
8. There are a few sport sections at the University.
9. The period of studies at higher school is generally 7 years.
10. Anybody who has got secondary education may enter the University.

4. a) Fill in the words from the list to make phrases.

1…… challenges	5. …….. qualified
2.public ……	6. up-to-date ……
3…….. scholarships	7. …….. application.
4. military ……	8. refresher ……

b) Make sentences using the completed phrases

5. Match the antonyms.

1. compulsory	a. theoretical
2. highly qualified	b. optional
3. full-time	c. out-of-date
4. important	d. extra mural
5. practical	e. poorly trained
6. up-to-date	f. insignificant

6. Translate the following sentences.

1. Київський Національний університет технологій і дизайну – один з найстаріших університетів у світі.
2. Студентські роки – найкращі роки в житті молоді.
3. Мета освітньої програми на хімічному факультеті – забезпечити студентів знаннями в галузі загальної та спеціальної хімії.
4. Суспільна діяльність – одна з найважливіших видів діяльності сучасних студентів.
5. В університеті буде ще більше лабораторій у наступному році.

7. Translate the following words into English.

Університет, обов'язкова освіта, факультет, стипендія, лабораторія, обладнання, стаціонар, заочне відділення, військова кафедра, практичне застосування.

8. Translate the words in brackets into English.

1. (Є) many universities in our country.
2. The University (був заснований) in 1930.
3. The Kyiv National University of Technologies and Design (нараховує) more than 6000 students, 8 faculties, 32 departments.
4. There are many (спортивних секцій).
5. There are laboratories provided with **(**сучасним**)** equipment where students carry out various experiments.

9. Choose the word which is nearly the same in meaning to the initial one.

Curriculum - programme, textbook, plan, timetable.
Investigation - study, experiment, practice, work.
Technique - way, method, analysis, skill.
Vital - serious, important, essential, alive.
Exercise - work, practice, job, activity.

10. Match the functions of education (1-6) with their explanations (a-h).

1. Education opens new vistas
2. Education helps in decision-making
3. Education makes better citizens
4. Education spreads awareness
5. Education ensures a productive future
6. Education bolsters confidence

a) Education makes a worthy contribution to our lives, by making us responsible citizens. We get to know our history and culture through education and imbibe those values. Education opens our mind and expands our horizon. It enables us to understand our duties as a citizen and encourages us to follow them. There is no denying the fact that an educated person is a better citizen.

b) Education is futuristic in character, in so far that it ensures that the one who receives good education gets a secure future. Our productivity is increased by acquiring new skills and talents through education. We find ourselves in the most competitive jobs, courtesy the right training and education. The importance of education is evident by the dizzy heights we achieve in life.

c) The significance of education, for a great part, lies in its ability to open new vistas for us. It expands our outlook and teaches us to be tolerant towards other views. An educated person will find it easier to understand a different point of view than the one who is uneducated. Education broadens our mental landscape and is the way forward to greater enlightenment - the ultimate goal of every human in life.

d) Awareness is a virtue in itself, given that the lack of awareness is lamented everywhere. Education spreads awareness, informing us about our rights and the services that we can access. On the most basic notes, it teaches us to differentiate between right and wrong. For most part of our lives, we falter in dichotomizing right and wrong, but the right education gives us the right answers.

e) Decision making is an integral part of our life. We have to take decisions throughout our lives and sometimes, decision making can be a very tough and challenging process. It can leave us perplexed and often wondering, as to what is the right choice. Education is significant, because it enables us to take the right decisions and prevents losses.

f) An educated person is a confident person. Education fosters a positive outlook and allows us to believe in ourselves. Self-belief is the most wanted trait in a human being and education leads us towards relying on ourselves, making us believe that we are ready to take on the world.

11. Retell the text according to the plan.

1. Education in our life
2. Kyiv National University of Technologies and Design
3. University facilities
4. Sport life

12. Watch the video "Why Education is so Important in our Life" and summarise the information why people need education. Explain the advantages of education for countries.

Unit 2

PHILOSOPHY OF EARLY CHEMISTS
Birth of Chemistry and Initial Stages of Its Development.

Chemistry**,** like other sciences, was born in the process of man's practical activities. In winning his means of existence man gradually came to know the causes of various phenomena and found practical applications for certain transformations of substances. Thousands of years ago people already knew how to obtain many useful materials. They knew how to smelt metals from their ores,

produce and utilize various alloys, manufacture glass and glassware.

In Egypt, technically the most advanced country of the ancient world, many trades based on the use of chemical processes flourished: long before our era. The Egyptians smelted iron from its ores, produced stained glass, knew how to tan leather, extract medicines, dyes and perfumes from plants, etc.

Chemical production in India and China dates from still earlier times.

Of course, the scraps of chemical information known at that time could hardly be called a science, but together with observations of natural phenomena they formed a basis for deliberation on the structure of matter and its transformations.

In the writings of ancient Hindu philosophers, we read that the universe is built up of a small number of simple substances.

A more comprehensive and integral philosophical conception of nature originated in ancient Greece. It propounded the idea that, the foundation of all things is uniform and that all the different substances the world consists of are various forms of a single principle.

Some Greek philosophers taught that all entities came from water. Others were of the opinion that the basic substance of the universe was air. Still others considered fire to be the origin of all things. In the V century B.C. Empedocles combined the ideas of his predecessors and added one more fundamental substance—earth — to the three pointed out by them, thus assuming the existence of four principles, which he called elements.

In the same century there arose an entirely new philosophical trend in the attempt to explain the structure of matter. The representatives of this trend were Leucippus and his disciple Democritus—the greatest-materialists of ancient times. According to Democritus, all bodies in nature are built up of minute solid impermeable and indivisible particles, which he called atoms. Atoms are so small that they cannot be seen. They may be infinitely different in shape and size, but they all consist of the same matter. There is nothing in the world but atoms, and the void between them. The differences between substances depend solely on differences in the number, shape and arrangement of the atoms they consist of. Atoms possess the property of eternal motion. The motion of atoms explains the contraction of bodies when cooled and their expansion when heated, their mixing with water when dissolved and other phenomena. Changes of all kinds consist merely in the combination and separation of atoms.

The materialistic teachings of Democritus were far in advance of the views of his contemporaries, but did not receive general recognition. In its further development philosophy tended to attribute all phenomena to the abstract properties of substance. This philosophy was grounded on the teachings of Aristotle (384-322 B.C.) which greatly influenced the subsequent development of natural science.

Aristotle held that the basis of all material being was prima materia, which is eternal and cannot be formed from nothing nor turn into nothing; its quantity in nature

is unchangeable. Initial matter has four fundamental qualities, which are perceived by our senses and stand opposite each other by pairs: heat and coldness, dryness and wetness. The diversity of substances depends on combinations of these qualities in different proportions. Combining the qualities by pairs Aristotle arrives at the four elements of Empedocles — earth, water, fire and air.

According to Aristotle, the fundamental qualities are not connected inseparably with initial matter, but can be taken from or added to it. For instance, when we heat water we take coldness from it and add heat to it; the water evaporates, i.e., turns into air, as Aristotle thought. Hence the conclusion comes that elements could be transformed into one another. Therefore, the art of creating various substances boiled down to the combining of definite qualities.

The Greek philosophers grounded their general conceptions of natural phenomena only on observation; the productive forces of society at that time were still far from the level at which a precise science based upon experiment could arise.

While in Greece philosophers concentrated mostly on abstract theories, attempting to grasp the intrinsic structure of matter, in other countries practical facts on chemical change were gradually being accumulated.

According to the opinion prevailing today, chemistry, as a collection of various information, often enveloped in mystical form, arose at the beginning of our era (A.D.) in Alexandria, a city on the Nile. Alexandria was an immense commercial and cultural centre that attracted people and goods from all over the ancient world. It concentrated and disseminated the practical knowledge which had existed in Egypt since times immemorial; there the philosophical ideas of ancient Greece found their further development. Treatises written in Alexandria in the first century A.D. contained a great deal of chemical information, many illustrations showing chemical apparatus, descriptions of the operations of calcining, volatilization, filtration, dissolving and crystallization. Here also arose the idea of transmuting base metals into gold, an idea which diverted chemistry for a long time to come to the path of fruitless searching, thus retarding its progress.

Vocabulary

application – використання;
deliberation – роздуми, дискусія;
means of existence – засоби існування;
to smelt – плавити;
alloy – сплав, суміш;
flourish – процвітати;
stained – тут: кольоровий
scraps – уривки;
predecessor – предок;
disciple – послідовник;
impermeable – герметичний;
minute – найдрібніший;
merely – просто
to attribute – приписати, віднести;
to disseminate – поширювати;
calcining – декарбонізація;

volatilization – випаровування;
retarding – гальмуючи.

1. Read the text carefully and answer the following questions.

1. What did people know how to do thousands of years ago?
2. What were many trades based on in Egypt in ancient times?
3. What formed the basis for deliberation on the structure of matter and its transformations at that time?
4. What was the universe built up of according to the writings of ancient Hindu philosophers?
5. What did the philosophical conception of nature originated in ancient Greece propound?
6. How did Greek philosophers describe the original basis of all things?
7. How did Empedocles change the ideas of his predecessors in the V century B.C.?
8. What new philosophical trend in the attempt to explain the structure of matter arose in the V century B.C.?
9. Who were the representatives of this trend?
10. Did Democritus' views receive general recognition?
11. How did Aristotle explain the origin of matter?
12. What did the Greek philosophers ground their general conceptions of natural phenomena on?
13. When and where did chemistry as a collection of various information arise?
14. What other ideas were further traced in the history of chemistry?

Complete the sentences inserting a word or a word combination from the text above.

1. Thousands of years ago people already knew how (…) many useful materials.
2. The Egyptians smelted iron from its (…), produced stained glass, knew how to tan (…), extract medicines, dyes and perfumes from …), etc
3. Some Greek philosophers taught that all entities came from (…).
4. According to Democritus, all bodies in nature are built up of (…), impermeable and indivisible particles, which he called (…).
5. The motion of atoms explains the (…) of bodies when cooled and their (…) when heated, their mixing with water when dissolved and other phenomena.
6. Aristotle held that the basis of all material being was (…), which is eternal and cannot be formed from nothing nor turn into nothing; its quantity in nature is unchangeable.
7. The Greek philosophers grounded their general conceptions of natural phenomena only on (…).
8. According to the opinion prevailing today, chemistry, as a collection of various information, often enveloped in mystical form, arose at the beginning of our era (A.D.) in (…), a city on the Nile.

3. ***Give synonyms for the following words.***

To obtain, to produce, to utilize, various, flourish, to consist, opinion, to

combine, fundamental, existence, trend, attempt, to be grounded on, eternal, quality, for instance, information, immense, a great deal of, treatises.

4. Translate the following words and collocations into Ukrainian.

Various phenomena, practical applications, useful materials, produce and utilize various alloys, chemical processes, stained glass, chemical production, scraps of chemical information, observations of natural phenomena, simple substances, integral philosophical conception of nature, fundamental substance, an entirely new philosophical trend, minute solid impermeable and indivisible particles, the motion of atoms, the materialistic teachings, far in advance, prima materia, fundamental qualities, the diversity of substances, initial matter, a precise science, intrinsic structure of matter, treatises, a great deal of chemical information.

5. Translate the following words and collocations into English. Then make a sentence with each of them.

Виробництво хімікатів, основні якості, рух атомів, різноманітні сплави, спостереження природних феноменів, прості речовини, первинна речовина, зовсім нова філософська тенденція, практичне застосування, неподільні частинки, випаровування, розчинення

6. Translate the following sentences into English. Use the vocabulary from the text.

1. Тисячі років тому люди знали як видобувати багато корисних речовин.
2. Єгипет був найбільш розвиненою країною у древні часи.
3. Єгиптяни вміли виробляти кольорове скло.
4. Роздуми про структуру речовини та її перетворення ґрунтувалися на інформації про хімію, що зберігалася з давніх часів співспостереженнями за природними явищами.
5. У Стародавній Греції філософське розуміння пропонувало ідею про те, що всі речовини у світі складаються з різних форм однієї головної речовини.
6. В наш час вважають, що уявлення про хімію, як сукупність різноманітної інформації, з’явилося на початку нашої ери.

7. Make a plan of the text and give a summary to cover the term ‘Birth of Chemistry and Initial Stages of Its Development’.

8. ***Watch the video and answer the questions.***

1. How the fire influenced the life of humans in the past?
2. What did the Egyptians do 6000 years ago?
3. Describe Egyptian paints.
4. When were alloys discovered?

5. What can you say about China and bronze?
6. When did iron production start?
7. When did Indians start making steel?
8. Who suggested the idea of atoms?
9. What can you say about Aristotle's ideas?
10. What can you mention about the Romans' contribution to chemistry?

Unit 3

THE SCIENCE OF CHEMISTRY

Chemistry deals with the properties, composition and structure of the materials our world and all that it contains are composed of, with the changes by which these materials are converted into other materials and the accompanying energy changes. On the one hand chemistry is linked with biology through biochemistry, and on the other hand with physics through physical chemistry. Chemistry is concerned with different forms of matter, such as water, salt, iron, sugar, oxygen, etc. the connection of chemistry with energy has to do with the energy changes that accompany chemical transformations of matter from one form into another. All changes of one kind of matter into another are accompanied by the absorption or liberation of energy, usually in the form of heat.

There are more than 30 different branches of chemistry. Some of them are: inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry, nuclear chemistry, colloidal chemistry, and electrochemistry.

Inorganic chemistry deals with substances obtained directly or indirectly from minerals, ores and similar sources.

Organic chemistry deals with substances which are composed in part of carbon, and many of which are associated in some ways with living bodies, plants and animals.

Physical chemistry is concerned with those parts of chemistry which are closely linked with physics. Physical chemistry includes many of the principles of physics as well as those of chemistry. The knowledge of this division of the science is particularly important in all fields of chemistry, since its fundamental laws are the basis all the different divisions are established upon.

Analytical chemistry is concerned with the identification, separation and

quantitative measurement of the composition of different substances that occur in nature.

Nuclear chemistry deals with the transformations of atomic nuclei and with the reactions which take place between them.

Colloidal chemistry is concerned with special properties of substances in a finely dispersed condition.

Electrochemistry is concerned with the relation between electrical energy and chemical change. Electrolysis is the process whereby electrical energy causes a chemical change in the conducting medium, which usually is a solution or a molten substance. The process is generally used as a method of deposition of metals from a solution.

1. Words and word-combinations to be remembered.

convert into – перетворювати на
accompany – супроводжувати
composition – склад
liberation – визволення, звільнення, виділення
atomic nuclei – атомне ядро
deposition – виділення, осадження (відкладення осаду)
solution - розчин
whereby – згідно з яким, за допомогою якого
molten – рідкий, розплавлений
conducting medium- середовище проведення/пропуску (повітря, води, струму)

2. Answer the following questions.

1. What does chemistry deal with?
2. What sciences is chemistry linked with?
3. What forms of matter is chemistry concerned with?
4. What are all changes of one kind of matter into another accompanied by?
5. What are the main branches of chemistry?
6. What substances does inorganic (organic) chemistry deal with?
7. What is physical chemistry concerned with?
8. Why is the knowledge of physical chemistry particularly important?
9. What branch of chemistry is concerned with the identification, separation and composition of different substances?
10. What process is called electrolysis?

3. Mark the following statements as true(T) or false(F).

1. Chemistry deals with the properties, composition and structure of the materials our world and all that it contains are composed of.
2. Electrochemistry is concerned with the relation between electrical energy and chemical change.

3. There are 3 different branches of chemistry.
4. Physical chemistry includes many of the principles of organic chemistry.
5. Inorganic chemistry deals with substances obtained from minerals.
6. Analytical chemistry is concerned with living organisms.
7. Organic chemistry deals with substances which are composed in part of carbon, and many of which are associated in some ways with living bodies, plants and animals.
8. Nuclear chemistry deals with the transformations of one substance into another.
9. Colloidal chemistry is concerned with special properties of substances in a finely dispersed condition.
10. Electrolysis is the process whereby electrical energy causes a chemical change in the conducting medium

4. Translate the following words into Ukrainian.

Property, composition, structure, production, nature, electricity, different, connection, energy, chemical, transformation, liberation, inorganic, analytical, directly, indirectly, substance, physical, closely, division, particularly, important, separation, measurement.

5. Match the words with their definitions.

1. джерело	a) to deal with
2. розглядати	b) in part
3. частково	c) is composed of
4. складається з	d) have to do with
5. відношення	e) branch
6. особливо	f) solution
7. бути пов’язаним з	g) source
8. мати відношення до	h) particularly
9. кількісний	i) to be concerned with
10. галузь	j) quantitative
11. розчин	k) relation

6. Translate the following words into English.

Органічна хімія, електрохімія, властивості, реакція, хімія, поняття, термін, речовина, галузь хімії, енергія, неорганічна хімія, фізична хімія.

7. Fill in the words from the list to make phrases.

1. physical …….	5……. measurement
2. ……. transformations	6. ……. nuclei
3. liberation of …….	7. dispersed …….
4. fundamental……	8. molten …….

8. Make sentences using the completed phrases.

9. Fill in the gaps with the given words.

Recognition, inorganic, basis, colloidal, served, development, basis, progress, close, enables.

1. … chemistry deals with substances obtained directly or indirectly from minerals,
   ores and similar sources.
2. … chemistry is concerned with special properties of substances in a finely dispersed
   condition.
3. The achievements of our scientists have won a world-wide …
4. The classical works of Russian scientists … as a theoretical … for the … of the chemical industry.
5. The … links between science and industry … the chemical industry to make great…

10. Translate the following sentences paying attention to the meaning of the given words.

To deal with – мати справу, розглядати
As well as – так, як і
To be concerned with – мати відношення
To have to do with – мати відношення
In part - частково
Result in – призводити до
On the one hand – з однієї сторони
On the other hand – з іншої сторони
So far – до теперішнього часу
Such as – такий, як
Whereby – причому, завдяки чому

1. Both chemistry and physics deal with matter and energy.
2. Chemistry as well as physics are key subjects.
3. Physics is concerned with the production, nature and effects of different forms of energy.
4. Many of the most interesting and important things in nature have to do with solutions.
5. Organic chemistry deals with substances which are composed in part of carbon.
6. A physical change may result in a change of the properties of a substance.
7. On the one hand chemistry is concerned with biology, and on the other it is concerned with physics.
8. So far no chemical reaction has ever converted one element into another.
9. Some metals, such as gold, platinum and silver do not combine with oxygen directly.
10. Distillation is the process whereby liquids are purified.

11. Write a summary of the text.

12. Retell the text according to the summary.

13. ***Watch the video and answer the questions.***

1. What Is Chemistry?
2. Which spheres of life chemistry is used in?
3. What is the definition of chemistry?
4. Which branches of chemistry can you name?

Unit 4

MATTER, ITS STATES AND FORMS

Matter is commonly described as anything that occupies space and has mass. It includes all materials found in nature. Some materials are made up of parts that are not alike. The dissimilarities may be subtle, or they may be readily apparent. Matter that has parts with different properties is said to be heterogeneous. Granite, a common rock, is heterogeneous because it is composed of different minerals, each having characteristic properties. Distinctly different parts are easily observed. Other materials appear uniform throughout; all parts are alike. The properties of any one part are identical to the properties of all other parts. Matter that has identical properties throughout is homogeneous. Sugar and ordinary table salt are examples of homogeneous materials.

Matter may exist in three physical states: solid, liquid and gas. It is possible to change matter from one state to the other by changing its temperature. For instance, a piece of ice is called a solid; it may melt and form liquid; as it evaporates, liquid water changes into a vapour, i.e. into the gaseous state. Many kinds of matter, like water, can be obtained in each of the three states; for some, however, extraordinary means have to be used in order to produce one, or even two of the states; and for others, only two states are known or can be produced.

Common salt for example, exists normally as a solid; at a temperature of several hundred degrees, it can be liquefied; and at still higher temperature it is converted into vapour. Carbon, a solid under normal conditions, can be vaporized, but it has never been liquefied.

Solids have both a definite volume and a definite shape. Liquids too have a definite volume but they take the shape of their containers. Gases have neither a definite shape nor a definite volume. A chemist must have a thorough knowledge of the states of matter and of the physical laws which govern the behaviour of matter in various states.

That all matter is composed of molecules is known to everybody. The question which must be answered, then, is: if all matter is composed of molecules, what is the essential difference between the states of matter? The answer to this question is that the essential difference between these states is the relative quantities of energy molecules possess in different states.

Vocabulary

similarity- схожість
subtle- тонкий, ледь помітний
dissimilarity- розбіжність
apparent- очевидний
heterogeneous- гетерогенний
solid- твердий
liquid- рідкий
evaporate- випаровуватися
vapour- пара
volume- об'єм

1. Answer the following questions.

1. What is matter?
2. What matter is said to be heterogeneous?
3. What matter is said to be homogeneous?
4. What are the main physical states of matter?
5. Is all matter composed of molecules?
6. What is the essential difference between the states of matter?
7. Is it possible to change matter from one state to the other one?
8. Can many kinds of matter be obtained in each of the three states?
9. Does matter include all materials found in nature?
10. What are examples of homogeneous materials?

2. Fill in the gaps with the given words.

Thorough, homogeneous, various, neither ... nor, as, carbon, among, heterogeneous, relative, possess, a common knowledge, never, govern, both … and.

1. The matter exists in three physical states is … .
2. A piece of ice may melt and form a liquid … it evaporates.
3. Carbon has … been liquefied.
4. Solids have … a definite volume … a definite shape.
5. Gases have … a definite shape … a definite volume.

6. A chemist must have … knowledge of the physical laws which … the behaviour of matter in … states.
7. The essential difference … the three states of matter is the … quantities of energy molecules … in different states.
8. Matter that has parts with different properties is said to be ….
9. Matter that has identical properties throughout is ….
10. …, a solid under normal conditions, can be vaporized, but it has never been liquefied.

3. Translate the following words into Ukrainian.

Vapour, evaporate, evaporation, define, definition, definite, know, knowledge, possible, impossible, possibility, state, statement, change, changeable, unchangeable, produce, product, production, behave, behavior, differ, difference, different.

4. Translate the following words into English

Властивості, тверда речовина, об'єм, закон, рідина, молекула, танути, отримувати, випаровуватись, матерія, стан, кількість, зміна, складатися з

5. Translate the following sentences paying attention to the given words and word-combinations.

As – в той час як (коли); в міру того як; так як; як.

1. As he was making his experiment he observed an interesting phenomenon.
2. As the reaction goes on the reacting substances are used up and new ones are formed.
3. As chlorine is 2.5 times heavier than air it may be collected by displacing air.
4. In the laboratory, time is usually measured and expressed as the unit.
5. As we have already learned, the molecules of ideal gases do not interact with each other.

To be a common knowledge – бути загальновідомим.

That water is a universal solvent is a common knowledge.

To be familiar with – бути знайомим, знати.

We are most familiar with water in its liquid state.

6. Match two parts of the columns.

Matter	зміна
Solid	об'єм
Liquid	отримувати
Chemist	матерія
Gas	тверда речовина
To obtain	приклад
Shape	хімік
Volume	рідина
Example	форма
Change	газ

7. ***Translate the words in brackets into English.***

1. Matter is commonly (описувати) as anything that occupies space and has mass.
2. Gases have neither a definite shape nor a (певний) volume.
3. Many kinds of matter, like water, can be (отримувати) in each of the three states.
4. Common salt for example, (існувати) normally as a solid.
5. Carbon, a solid under normal (умови), can be vaporized, but it has never been liquefied.

8. ***Are the following sentences true or false?***

1. Matter that has parts with different properties is said to be homogeneous
2. Matter is commonly described as anything that occupies space and has mass.
3. Matter that has identical properties throughout is heterogeneous.
4. Gases have definite shape.
5. Matter that has parts with different properties is said to be heterogeneous
6. Solids have both a definite volume and a definite shape.
7. That all matter is composed of molecules is known to everybody.
8. Some materials are made up of parts that are alike.
9. Many kinds of matter, like water, can be obtained in each of the three states.
10. Liquids have a definite volume but they take the shape of their containers.

9. Make a plan of the text and give a summary to cover the topic.

10. ***Watch the video and answer the questions***

1. How many states of matter do you know?
2. What can you say about the properties of solids?
3. Describe the propertied of liquids.
4. What are the properties of gases?
5. What can you say about plasma?

Unit 5

ELEMENTS

We meet the idea of an element very early in our study of chemistry. The ancients suspected that there must be some very simple substances from which more complicated ones were built. At one time they thought that everything might

be made up of earth, air and water; these got the name ‘element’ which comes from the same word as ‘elementary’ or simple.

This idea, though wrong, is still a rather important one. The first man to recognize the modern type of element was Robert Boyle in the middle of the 17 century. His idea was that an element was just something which could not be broken down chemically into anything simpler. He knew of metals like iron, copper, tin, lead, gold and silver and non-metals like carbon and sulphur, all the gases being called ‘air’.

In the years since Boyle first defined an element in the modern sense over one hundred different ones have been defined. Some of these are rather common and well-known but quite a lot are man-made. Examples are mendeleyevium, nobelium and laurencium. One of the first distinctions between elements was the division into metals and non-metals.

We have seen that a dull-red mercuric oxide is decomposed into mercury and oxygen. The weights of oxygen and mercury obtained are together equal to the weight of mercuric oxide. Similarly, water is decomposed by electrolysis into oxygen and hydrogen. No chemist, however, has been able to separate any other substances from mercury, oxygen or hydrogen: these three substances are known, therefore, as elements. An element is a substance which, so far as is known, contains only one kind of atom. It has been found possible to resolve all known substances into about 109 elements: many of these are rare, and relatively few are common in nature.

Sugar, starch, cellulose, wood and paper, for example, differ from one another in many ways, yet each of these substances is composed of the same three elements: carbon, hydrogen and oxygen. Just as several thousand bricks may be arranged to form many different types of buildings, so may the atoms of elements be arranged in different ways to form molecules of different types of matter.

Astronomers have found that the same elements which are common on Earth, e.g. nitrogen, carbon and hydrogen, are also the commonest in the Sun and other stars. Thus elements are the primary building materials of the Universe.

Vocabulary

complicated-складний
man-made- штучний, створений людиною
equal- рівний, рівнозначний
decompose- розкладати, розчиняти
matter- речовина
starch-крохмаль

1. Answer the following questions.

1. What is mercuric oxide decomposed into?
2. Are the masses of oxygen and mercury together equal to the mass of mercuric oxide?

3. Can any chemist divide mercury, oxygen or hydrogen?
4. What is an element?
5. How many elements do you know? Name some of them.
6. What properties are common for sugars, starch and wood?
7. What have astronomers found?
8. Are the elements the primary building material of the Universe?
9. Do we meet the idea of an element very early in our study of chemistry?
10. Who was the first man to recognize the modern type of element?

2. Match two parts of the columns.

Simple substances	метали
The same word	рівні по вазі
Man-made elements	інші способи
Other ways	прості речовини
Chemical elements	штучні елементи
Metals	теж саме слово
Equal to weight	хімічні елементи

3. ***Remember the following common elements and their symbols.***

Aluminum	Al	Magnesium	Mg
Antimony	Sb	Manganese	Mn
Arsenic	As	Mercury	Hg
Barium	Ba	Nickel	Ni
Bismuth	Bi	Nitrogen	N
Bromine	Br	Oxygen	O
Calcium	Ca	Phosphorus	P
Carbon	C	Platinum	Pt
Chlorine	Cl	Potassium	K
Chromium	Cr	Silicon	Si
Cobalt	Co	Silver	Ag
Copper	Cu	Sodium	Na
Fluorine	F	Strontium	Sr
Gold	Au	Sulfur	S
Hydrogen	H	Tin	Sn
Iodine	I	Titanium	Ti
Iron	Fe	Tungsten	W
Lead	Pb	Zinc	Zn

4. ***Translate the following sentences paying attention to the given words and word-combinations.***

Rather than – а не
Rather – досить
Rather … than – скоріше…ніж
The work done is rather experimental than theoretical.
It is much better to use liquid hydrogen rather than compressed gas.
This theory is rather difficult for understanding.

The measurement of this experiment is rather inconvenient.

The experiments are considered to be rather difficult.

Either … or – чи…чи, або…або
Neither… nor – ні…ні

When elements combine heat energy is either liberated or absorbed.

The composition eventually becomes uniform when you take either any mixture of gases or a solution.

Neither the protons nor the neutrons or electrons involved in the process of fusion disappear. No do they become smaller.

5. Translate the following words into Ukrainian.

Atom, elements, metals, non-metals, substance, simpler, liquid, decomposed, oxide, electrolysis, rare, common, building materials, weight, to contain, to resolve, nature, mass, to separate, properties.

6. ***Translate the words in brackets into English.***

1. (елемент) is a substance which, so far as is known, contains only one kind of atom.
2. One of the first (різниця) between elements was the division into metals and non-metals.
3. The ancients (підозрюють) that there must be some very simple substances from which more (складний) ones were built.
4. The weights of oxygen and mercury obtained are together (дорівнює) to the (маса) of mercuric oxide.
5. Thus elements are the (основний) building materials of the Universe.

7. Which of the following is not mentioned in the text?

1. An element is a substance which, so far as is known, contains only one kind of atom.
2. The first man to recognize the modern type of element was Robert Boyle.
3. Scientists can often predict where earthquakes will happen.
4. Each rock tells geologists about its past.
5. Elements are the primary building materials of the Universe.
6. One of the first distinctions between elements was the division into metals and non- metals.
7. Now the oceans affect the climate around the world.
8. To measure earthquakes scientists, use a tool called seismometer.
9. No chemist, however, has been able to separate any other substances from mercury, oxygen or hydrogen: these three substances are known, therefore, as elements.
10. Astronomers have found that the same elements which are common on Earth, e.g. nitrogen, carbon and hydrogen, are also the commonest in the Sun and other stars.

8. Fill in the gaps with the given words and word-combinations.

To resolve, electrolysis, so far as, one, weight

1. An element is a substance which, is … known, contains only one kind of atom.
2. This idea, though wrong, is still a rather important ….
3. It has been found possible … all known substances into about 109 elements: many of these are rare, and relatively few are common in nature.
4. Water is decomposed by … into oxygen and hydrogen.
5. The weights of oxygen and mercury obtained are together equal to the … of mercuric oxide.

9. Make a plan of the text and give a summary to cover the topic.

10. Watch the video and answer the questions.

1. What is the definition of an element?
2. What do we use chemical symbols for?
3. How are elements classified?
4. Describe the properties of metals.
5. What can you say about metalloids?
6. What are the properties of non-metals?
7. Describe the states of metals.

Unit 6

SOLUTIONS

We know a solution to be a uniform mixture of one substance in another. The material to be dissolved is the solute and the substance which does the dissolving is the solvent. The rate at which a substance may be dissolved can be controlled in several ways. The surface area, the agitation, and the temperature all are found to have an effect on the rate of solution. The ease with which a substance may be dissolved is known to be its solubility. The solubility of solid, liquid, or gaseous solutes is determined by a number of factors, such as the nature of the solvent, the nature of the solute, the temperature and the pressure. In a solution the solute cannot be separated from the solvent by filtration.

The concentration of solute in solution may vary from dilute (a small amount of solute relative to the solvent) to concentrated (a large amount of solute relative to the solvent).

Some solutions are so common to us that we give them a unique name. A solution of water and sugar is called *syrup. A* solution of sodium chloride (common table salt) in water is called *brine. A* sterilized specific concentration (0.15 molar) of sodium chloride in water is called *saline. A* solution of carbon

dioxide in water is called *seltzer,* and a solution of ammonia gas in water is called *ammonia Mater.* A solution is said to be *dilute if* there is less of the solute. The process of adding more solvent to a solution or removing some of the solute is called *diluting. A* solution is said to be *concentrated if* it has more solute. The process of adding more solute or removing some of the solvent is called *concentrating.* The *concentration of* a solution is some measurement of how much solute there is in the solution. It might initially offend your sensibilities to consider a solution in which the solvent is a gas or a solid. The molecules of a gas do not have much interaction among them, and so do not participate to a large extent in the dissolving process. Solids are difficult to consider as solvents because there is a lack of motion of the particles of a solid relative to each other. There are, however, some good reasons to view some mixtures of these types as solutions. The molecules of a gas do knock against each other, and the motion of a gas can assist in vaporizing material from a liquid or solid state. The fan in a 'frost free' home freezer moves air around inside the freezer to sublimate any exposed ice directly into water vapor, a process clearly akin to dissolving. Solid metals can absorb hydrogen gas in a mixing process in which the metal clearly provides the structure.

The material to be dissolved is the solute and the substance which does the dissolving is the solvent. The rate at which a substance may be dissolved can be controlled in several ways. The surface area, the agitation, and the temperature all are found to have an effect on the rate of solution.

Vocabulary

fluid – рідина
solvent – розчинник
solute - розчинена речовина
saline- соляний розчин
brine - соляний розчин
dilute - розбавлений
ammonia - аміак
participate - брати участь
to a large extent- в значній мірі

1. ***Answer the following questions to check your understanding of the text.***

1. What is a solution?
2. What is a solute?
3. What is a solvent?
4. What has an effect on the rate of solution?
5. What is solubility?
6. What factors is the solubility determined by?
7. What is a dilute solution?
8. What is a concentrated solution?
9. Is water a solvent?
10. What commonly used solvents do you know?

2. Find English equivalents for the following Ukrainian words.

Суміш, швидкість, відносний, розчинення, розчинна речовина, розчинник, поверхня, однаковий, неоднорідний, однорідний

3. Find Ukrainian equivalents for the following English words.

Uniform mixture, substance, mixture, liquid, fluid, solvent, solute, common, unique name, diluting, concentrated sensibilities, to a large extent, relative to each other, vaporizing material, dissolving, agitation, rate of solution, is determined by, pressure.

4. Give opposites of the following words.

Many, much, direct, new, small, negatively, charge, poor, thin, uneconomic, cool, to increase, little, old, indirect, few, good, economic, warm, thick, positively, large, discharge, rich, to decrease, big.

5. Write down the synonyms for the following words.

Secondary, special, application, frequency, cyclic, continuously, conclusion, statement, readiness, conductor, establish, specify, failure, magnitude, realize, dictionary.

6. Translate the following sentences. Be sure that you know the meaning of following words.

way - шлях, спосіб
way out - вихід
by way of- в якості, с ціллю
by the way - проте
in no way- ні в якому разі

1. By the way, before we go further with the discussion, we have first to learn more about the ways in which the probability of different single or complicated events can be calculated.
2. These reactions differ in many ways.
3. His way to the science was very difficult.
4. Water in no way should be mixed with this compound.
5. They investigated chemical properties of these substances by way of experimenting.

7. In what line of the text do you read.

1. That, the material to be dissolved is the solute.
2. That, the surface area, the agitation, and the temperature all are found to have an effect on the rate of solution.
3. That, the solubility of solid, liquid, or gaseous solutes is determined by a number of factors.
4. That, the concentration of solute in solution may vary from dilute.
5. That, the most common of the solvents is known to be water.

8. Translate the following sentences.

1. He proposed to use a new method of collecting data.
2. We had to return the books to the library because we were not allowed to borrow some new ones.
3. We were glad to see them.
4. He wanted the new method to be used in our laboratory.
5. This experiment was not difficult to be carried out in the students' laboratory.
6. We were proud to have been given prizes for our research.
7. He proposed to use a new method of collecting data.
8. We had to return the books to the library because we were not allowed to borrow some new ones.
9. We were glad to see them.
10. He wanted the new method to be used in our laboratory.
11. This experiment was not difficult to be carried out in the students' laboratory.
12. We were proud to have been given prizes for our research

9. Give English equivalents for the words in brackets.

1. I didn't want this text (перекладав) by him.
2. The students were glad (що отримали) excellent marks.
3. The report had (прочитати) by the lecturer.
4. (Збільшення) the surface of the liquid means (прискорення) the process of evaporation.
5. (Досліджувати) matter means (розглянути) its nature and structure.
6. (Пояснити) this fact is not so very easy.
7. There remain two constants (які потрібно виміряти).
8. The discharge (який потрібно дослідити) passes between the electrodes A and B.
9. The line (яку потрібно вести) will pass through this point.

10. Make a plan of the text and give a summary to cover the topic

11. ***Watch the video and answer the questions.***
    1. What is the definition of a solution?
    2. What are the properties of a solution?
    3. What are the parts of a solution?
    4. Which kinds of solutions can you name?
    5. How are solutions made?
    6. Tell about characteristics of solutions.

Unit 7

THE PERIODIC LAW

In spite of the importance of the earlier contributions, the major portion of credit for the development of the periodic system must go to the Russian scientist, Dmitri Ivanovich Mendeleyev. The realization that the properties of the elements can be *represented* as periodic functions of their atomic weights made possible classification that has *suffered* few significant changes in the *subsequent* years.

It was in March of 1869 that D. I. Mendeleyev published his first *account* of the periodic system, in which he set forth the *arrangement* of the elements in terms of their increasing atomic weights. D. I. Mendeleyev was the first to fully *appreciate* the *significance* of this *periodicity*. In his first paper D. I. Mendeleyev pointed out the similarities of a number of properties of certain elements and reversed the order of atomic weights where necessary in order to maintain this group *similarity*.

Of *considerable* interest and importance is the fact that D. I. Mendeleyev left *vacant* positions in his *proposed* table for yet undiscovered elements and *expressed* the *opinion* that the chemical and physical properties of the elements to be discovered might well be *predicted* from their positions in the table. In the summer of 1871 D. I. Mendeleyev published a more *comprehensive* treatment of what he called the Periodic Law. At this time, he presented the more familiar form of the periodic table and although it differs *somewhat* from the one that is in use today, it is *substantially* the same. It was in his publication of 1871 that D. I. Mendeleyev utilized the periodic character to predict the properties of the elements to be described later as those of scandium, gallium and germanium. The *remarkable agreement* of the properties of these elements as described by D. I. Mendeleyev and those to be observed later is certainly a complete *justification* of D. I. Mendeleyev's faith in his periodic law.

In December 1945 Glenn Seaberg made his first publication of a periodic table which *depicted* a new actinide series beginning with actinium. He said that American scientists were proud and happy to honour the name of D. I. Mendeleyev by calling element 101 "mendelevium".

Vocabulary

realization- усвідомлення
significant – значний

suffer changes – зазнавати змін
subsequent – наступний
considerable – значний
comprehensive – зрозумілий
remarkable – визначний
agreement- узгодження
justification - вмотивованість

1. Answer the following questions to check your understanding of the text.

1. Who contributed greatly to the development of the periodic system?
2. What did D. I. Mendeleyev realize?
3. When did D. I. Mendeleyev publish his first account of the periodic system?
4. What did he set forth in his account?
5. What did he point out?
6. What were vacant positions in the Table left for?
7. How many elements did D. I. Mendeleyev predict the properties of?
8. Why did American scientists call element 101 "mendelevium"?

2. ***Translate the following sentences.***

1. This scientist was the first to point out the importance of the phenomena observed.
2. They are the last to leave the laboratory.
3. D. I. Mendeleyev was the first scientist to arrange the elements according to their atomic weights.
4. Water to be used for drinking should be thoroughly purified.
5. The action to follow the combination of equal volumes of hydrogen and chlorine in sunlight is known as explosion.
6. Gold was probably one of the first metals to attract the attention of man.
7. The best solvent to be employed for dissolving phosphorus is carbon disulphide.
8. Sodium peroxide mixed with cupric oxide to serve as a catalyst, reacts with water, liberating oxygen.
9. Oxygen has considerable ability to form double bonds.
10. The hardest substance to cut different materials with is diamond.

3. Translate the following sentences. Be sure that you know the meaning of following words.

In spite of — не дивлячись на
in terms of — на підставі, з точки зору

1. In spite of the high boiling point mercury does show a small vapour presence at an ordinary temperature.
2. A material system may be described in terms of the phases constituting it. In spite of the fact that compounds of fluorine had long been known, the element is so active that it was not obtained in appreciable quantities until 1886.

3. It is assumed that pure water is a non-conductor, in spite of the fact that perfectly non-conducting water has not yet been made.
4. We can explain reduction in terms of atomic structure. Sometimes the data from which molecular weights are to be calculated are expressed in terms of the relative densities of gases.

4. Find Ukrainian equivalents for the following English words.

Account, agreement, appreciate, arrangement, comprehensive, considerable, depict, represent, set forth, significance, similarity, somewhat, substantially, subsequent, vacant.

5. ***In what line of the text you read.***

1. That, the importance of the earlier contributions, the major portion of credit for the development of the periodic system
2. That, D. I. Mendeleyev published his first *account* of the periodic system.
3. That, the similarities of a number of properties of certain elements and reversed the order of atomic weights where necessary in order to maintain this group *similarity.*
4. That, D. I. Mendeleyev left *vacant* positions in his *proposed* table for yet undiscovered elements.
5. That, the more familiar form of the periodic table and although it differs *somewhat* from the one that is in use today.
6. That, American scientists were proud and happy to honour the name of D. I. Mendeleyev by calling element 101 "mendelevium".

6. Find English equivalents for the following Ukrainian words.

Тісно пов’язаний, встановити зв'язок, порожнеча, розташування електронів на орбіті, той же самий, дозволити нам розпізнати, в кінці, відсутні елементи.

7. Give opposites of the following words.

List, predict, relate, repetition, show, single, suggest, try.

8. Write down the synonyms for the following words.

Arrange, assist, certain, closely, common, concept, indicate.

9. Give English equivalents for the words in brackets. Be sure that you understand the text.

1. There are certain natural groupings among the chemical elements in which every element (*тісно пов’язаний*) the other elements in its group. In order to understand better these groupings, chemists have tried to fit the elements into a single plan.
2. One of the earlier attempts (*встановити зв’язок*) among the elements into a single law was made by John Newlands in England, who suggested the Law of Octaves.

3. This concept of the periodic repetition of properties was further developed by a Russian chemist Dmitriy Mendeleyev who created a Periodic Table in which he arranged the elements according to their atomic weights and corresponding chemical properties.
4. D.I. Mendeleyev listed the elements known at the time (1869) in the order of their atomic weights from the lightest to the heaviest. The elements were arranged in a table of eight columns; elements having similar properties appeared in the same columns or groups in the table. Mendeleyev even predicted that there were undiscovered elements and left (*порожнеча*) in this table for the new discoveries.
5. There are many ways the Periodic Table can be used. The table can be used to find the atomic number. The atomic weight is also indicated in the table.
6. (*Розташування електронів на орбіті*) is shown for each of the elements. The common oxidation states are given. For most elements these numbers are (*той же самий)* as the valence numbers. The table (*дозволити нам розпізнати)* families of elements. For example, copper (29), silver (47), and gold (79) will all be found in the same column. They have similar properties and are considered a chemical family. And (*в кінці*) the table can be used to predict the properties of the elements. The fact that the Periodic Table can assist in predicting properties of elements has helped in the discovery of (*відсутні елементи*).

10. Make a plan of the text and give a summary to cover the topic.

11. ***Watch the video and answer the questions***

1. Give the definition of the periodic table.
2. How many elements are there in the Periodic Table?
3. How many elements can we find in nature?
4. Which elements are present in the human body?
5. Give the definition of an atom.
6. How do atoms react with each other?
7. What can tell us the position of an element in the table?
8. How does periodic table organise elements?
9. Why is the Table called “Periodic”?

Unit 8

STRUCTURE OF ATOMS

All kinds of matter are now known to consist of little particles called molecules; these molecules in turn are discovered to consist of still smaller

particles called atoms. The name *"atom"* comes from the Greek word meaning *"indivisible"* because atoms were supposed to be completely indivisible. Until the end of the nineteenth century an atom considered to be a "*simple, solid, hard, impenetrable particle*". Now it is believed to contain (except for hydrogen) three kinds of particles, these occupying only a portion of the whole space of the atom. The particles are electrons, protons and neutrons. The existence of these particles in the atoms of the elements is fully established.

Electrons are negatively charged. They are thought to lie in different groups about the nucleus of the atom. If atoms of matter contain negative electricity it is evident that they must contain also positive electricity in an equal amount: otherwise they would not be electrically neutral. The positively charged atom of hydrogen is a proton. The hydrogen atom is stated to contain only one electron and one proton, and when the electron is removed from the atom, only the proton remains. Since the electron's weight is considered to be almost negligible, the mass of the proton is very nearly equal to the mass of the hydrogen atom. The mass of the proton is found to be 1836 times greater than that of the electron. The electrical charge of the proton is equal in magnitude to the charge of the electron, but it has the opposite sign (+ instead of -). The neutron has no charge at all and its mass is assumed to be approximately equal to that of the proton.

The electrons are the outer portion of the atom. The electrons and the nucleus are very small as compared with the size of the atom, which, therefore, appears to be composed largely of empty space. The diameter of the whole atom is estimated to be of the order of 10^{-8} cm, while that of the nucleus is believed to be very much smaller.

The atomic weight of an element tells us the number of protons and neutrons in the nucleus of an atom. Now if we could determine the positive charge of the nucleus, we should then know the number of electrons in the atom, as the total charge of electrons is equal to the charge of the nucleus.

Vocabulary

indivisible – неподільний
impenetrable – непроникливий
nucleus – ядро
remain – залишатися
approximately – приблизно
charge - заряд

1. ***Answer the following questions to check your understanding of the text.***

1. Do all kinds of matter consist of molecules?
2. Are atoms indivisible?
3. Must atoms contain positive electricity?
4. Has the electrical charge of the proton the opposite sign as compared with that of the electron charge?
5. Has the neutron got any charge?
6. What do all kinds of matter consist of?

7. What is the meaning of the Greek word "atom"?
8. How many kinds of particles does an atom contain and what are their names?
9. What is a proton?
10. How many electrons and protons does the hydrogen atom contain?
11. What sign has the electrical charge of the proton?

2. Translate the following sentences. Be sure that you know the meaning of the following words.

as compared (to, with) — у порівнянні
except (for) — за винятком

1. Oxygen is twice as soluble as compared to nitrogen.
2. Hydrofluoric acid is a relatively weak acid as compared with the binary acids of the other elements.
3. Sodium is very unlike the common metals except that it also has a metallic lustre.
4. Corundum is the hardest of all naturally occurring substances except diamond.
5. The chemical properties of ozone are similar to those oxygen except for its greater chemical activity.
6. The electrons and the nucleus are very small as compared with the size of the atom.

3. ***Translate the following words.***

Approximately, as compared with, charge, consider, empty, estimate, fully, in turn, kind, largely, mean, negative, occupy, otherwise, particle, positive, sign, size.

4. ***Give opposites of the following words.***

Big, the beginning, soft, positive, complex, the same, unequal, to stay, to involve, outside, to gain, to join, to increase, to separate, to lose, inside, to evolve, to decrease.

5. ***Find English equivalents for the following Ukrainian word-combinations.***

У свою чергу, ще менші частки, за винятком водороду, у рівній кількості, у ... разів більше.

6. Translate the following sentences.

1. The composition of air is found to vary slightly with elevation.
2. The air is known to contain one fifth oxygen by volume.
3. Most substances have been found to expand as the temperature rises.
4. The temperature lower than —273° is not known to exist.
5. Water can be said to be a universal solvent.
6. Ground water has been stated to contain a great deal of impurities.
7. Water was believed by the ancients to be an element.
8. Oxygen can be said to represent the most widely distributed element on the Earth.

9. Hydrogen peroxide has been shown to resemble ozone in many ways.
10. Hydrogen peroxide is found to act both as a vigorous oxidizing agent and as a reducing agent.
11. Phosphorus and nitrogen have been proved by many experiments to differ radically in many respects.
12. Silicon is said to play an important part in the inorganic world.
12. The importance of carbon in organic chemistry is considered to result from its possessing the ability to form carbon-carbon bonds.

7. ***Write down the synonyms for the following words.***
matter, to make up, various, due to, capacity, different, to compose, substance, thanks to, ability.

8. ***Match English equivalents to Ukrainian ones.***

1. tiny particle	обумовлюватись
2. complex unit	розміщення електронів
3. to be due to	здатність поєднуватись
4. arrangement of electrons	складна одиниця
5. a shifting of electrons	найменша частка
6. combining capacity	рух електронів

9. In what line of the text you read.

1. That the name ***"atom"*** comes from the Greek word meaning "***indivisible***" because atoms were supposed to be completely indivisible.
2. That the hydrogen atom is stated to contain only one electron and one proton, and when the electron is removed from the atom, only the proton remains.
3. That the electrons and the nucleus are very small as compared with the size of the atom, which, therefore, appears to be composed largely of empty space.
4. That the atomic weight of an element tells us the number of protons and neutrons in the nucleus of an atom.

10. Give English equivalents for the words in brackets. Be sure that you understand the text.

Matter is composed of (найменшою) particles called atoms. The atom is a (складна одиниця) of various particles, the most important of which are electrons, protons, and neutrons.

The difference between atoms of different elements are due to differences in the number of (протонів) and neutrons in the nucleus and to differences in the arrangement of the electrons (оточених) the nucleus. The mass of the atom is concentrated almost (повністю) in the nucleus.

The chemical properties of different elements can be (пояснено) by the structure of the atom. Chemical changes (включають зсув) of outer (valence) electrons so that a shell is achieved. The activity of metals and non-metals is (мали) to the size of the atom and to the number of electrons in the external orbit.

The valence or combining (здібність) of an atom is determined by the number of electrons it (отримані), loses or shares in chemical combinations with atoms of other elements. Atoms also may be joined to other atoms by (поділеними на пари) of electrons. This process produces covalent (сполуки). These are generally gases or liquids with (низькими точками кипіння). (Окислення) involves the loss of electrons by the element. The process is accompanied by (алгебраїчне зменшення) in valence. Reduction, (з іншого боку) involves a gain of electrons by the substance reduced. This process is accompanied by an algebraic decrease in valence.

11. Make a plan of the text and give a summary to cover the topic.

12. ***Watch the video and answer the questions***

1. Describe the atom's main components.
2. Which elements do we call isotopes?
3. Describe the properties of electrons.
4. Where does electron get its energy?
5. What can you tell about the process "ionisation"?

Unit 9

PRINCIPLES OF QUALITATIVE ANALYSIS AND ENVIRONMENTAL MONITORING

Text A. Analytical chemistry

Chemists use two main types of analytical techniques. Qualitative analysis reveals which elements or compounds are present in a substance or mixture of substances. Quantitative analysis determines how much of each component there is. Certain techniques, such as some forms of spectrographic and chromatographic analysis, can make both determinations at the same time. These techniques tell the chemist both what is there and in what amounts.

Analytical chemistry determines the properties of chemical substances, as well as the structure and composition of compounds and mixtures. Much of the science of modern chemistry is built on results obtained from analyses. Many of chemistry's important uses, whether in helping to solve a murder case or discovering if a river is polluted, rely on analytical techniques.

The primary aim of analysis is to find out how a material is constituted. Thus,

a chemist may analyze a mixture to find which compounds are present. Or, he may analyze a pure compound to find from which elements it is formed.

The discovery of the different chemical elements also depended largely on developments in analytical techniques. For example, four elements (all relatively uncommon) derive their names from the Swedish town of Ytterby. Toward the end of the eighteenth century, the Finnish chemist Johan Gadolin identified what he thought was a new element. He had found it in a mineral (later called gadolinite) that he discovered near Ytterby. The element was named yttrium. It is one of a group of elements called the rare earth (lanthanides), which have very similar chemical properties. As analytical techniques improved during the nineteenth century, it was shown that Gadolin's yttrium was a mixture of several elements. First, two other elements — erbium and terbium — were isolated from it. Then these two were found to be mixtures of several elements. One of these elements was subsequently called ytterbium, thus celebrating Ytterby for the fourth time.

Separation. Analytical techniques are methods for finding out something specific about an element or compound. They are based on differences in the chemical and physical properties of materials. Sometimes, these differences are very small. This makes analytical work difficult and often time-consuming. An important set of analytical techniques are those that separate different compounds or elements. It was refinements in such techniques that led, for example, to the isolation and identification of the full range of rare earth elements.

Very sophisticated separation techniques have been developed during the twentieth century. Often, as in the case of chromatographic methods, they have roots in nineteenth-century research. It is now possible to separate very small amounts of complex molecules from one another. Much of the progress made in recent years in understanding the chemistry of biological processes has depended on the development of such techniques.

Detection. Analysis does not always depend on separation, however. One of the triumphs of modern analytical chemistry has been the development of other techniques. These can detect very small quantities of a particular substance in a complex mixture. Such techniques may be qualitative or quantitative. They may reveal only what material is there (the "quality"). They may also be able to tell how much of it is present (the "quantity"). For example, it is possible to detect very low concentrations of particular pollutants in the atmosphere. In general terms, the atmosphere is a simple mixture of nitrogen and oxygen gases. But these make up only about 99 per cent of its total volume. The remaining 1 per cent is a complex mixture that makes quantitative analysis of trace elements a demanding task. It can also be an essential one. The build-up of some pollutants could have a serious effect on world climate. This could make life as we know it more difficult than it is already.

These techniques, which have been developed for measuring very small quantities of particular molecules, often depend on their physical rather than their chemical behavior. In general, this means how they behave in the presence of

different types of radiation — infrared, radio waves, or laser light, for example.

There is one problem facing chemists in recent years - the ability to measure very small amounts of different substances has outstripped the ability to understand their significance. Thus, it is now possible to measure the presence of almost unbelievably small concentrations of certain impurities in food. What is not understood, in many cases, is whether or not there is a threshold level. Below such a level, an impurity would exert no harmful effect. Its presence would therefore be of no significance. This, however, is not really a problem for the analytical chemist, whose basic task is to find ways of obtaining the information.

Vocabulary

analysis (pl. analyses) – аналіз, метод вивчення;
to derive – походити;
lanthanide –антанид, рідкісний земельний елемент;
subsequently – згодом;
time-consuming – тривалий; той, що потребує багато часу;
trace element – мікроелемент;
impurities – домішки;
threshold – поріг.

1. Read the text carefully and answer the following questions.

1.What two main types of analytical techniques do chemists use? What do they reveal?
2. What does analytical chemistry determine?
3. What is the primary aim of analysis?
4. What does the discovery of different chemical elements depend on?
5. What are analytical techniques based on?
6. What do qualitative and quantitative techniques detect?

2. Explain the meaning of the underlined terms, or look them up in the explanatory dictionary.

3. Give synonyms for the following words.

Main, types, to reveal, to determine, amount, property, modern, to obtain, to solve, to find out, to improve, specific, small, difficult, important, roots, to detect, significance.

4. Translate the following words and collocations into Ukrainian.

Analytical techniques, certain techniques, spectrographic, chromatographic analysis, chemical substances, composition of compounds, results obtained from analyses, a murder case, primary aim, relatively uncommon, lanthanides, similar chemical properties, erbium and terbium, isolated from, subsequently, chemical and physical properties, time-consuming, refinements, the full range of rare earth elements, sophisticated, chromatographic methods, complex molecules, triumphs, particular pollutants, in general terms, total volume, trace elements, a

demanding task, essential, chemical behavior, infrared, radio waves, laser light, ability, to outstrip, certain impurities in food, a threshold level, harmful effect.

5. Translate the following words and collocations into English. Then make a sentence with each of them.

Якісний аналіз, визначати, сполука, хроматографічний аналіз, невелика кількість, склад суміші, властивість речовин, покладатися на, аналізувати суміш, залежати від, відкриття елементів, первинна ціль, лантанид, вдосконалюватися, відокремити, згодом, дещо конкретне, фізичні властивості, важливий комплекс, рафінування, повний ряд, визначення, складна техніка, біологічні процеси, розвиток, забруднювач, низька концентрація, кількісний, виявляти, складати, значний вплив, мікроелемент, вимірювання кількості, залежати від, домішки.

6. Continue the following sentences. Use the vocabulary from the text.

a. Analytical chemistry determines …
b. The primary aim of analysis is …
c. Analytical techniques are based …
d. The atmosphere is …
e. The ability to measure very small amounts of different substances …
f. The analytical chemist's basic task is …

7. Translate the following sentences into English. Use the vocabulary from the text.

a) Більша частина хімії як науки ґрунтується на результатах аналізів.
b) Якісний аналіз спрямовний на визначення елементів, з яких складається сполука.
c) Відкриття різних хімічних елементів значно залежало від розвитку аналітичних технологій.
d)Аналітичні методи ґрунтуються на відмінностях хімічних та фізичних властивостей матеріалів.
e) Хроматографічні методи використовувалися у дослідженнях у дев'ятнадцятому столітті.
f) Тепер можливо виявити наявність речовини навіть у невеликій кількості.

8.Make a plan of the text and give a summary to cover the term 'Analytical chemistry'.

Text B. Three types of analysis

An analytical chemist can perform one of three types of analysis on a given substance. Qualitative analysis identifies the various types of elements and compound that are in a substance. Quantitative analysis measures the amounts of the different chemicals in the substance being analyzed. Radiochemistry involves the identification and production of radioactive elements and their use in the study of chemical processes.

Classical analysis. There have been considerable advances in recent years in instrumental methods of chemical analysis. However, many analyses are still carried out by what are termed "classical methods." These employ techniques and procedures that have proved to be reliable and reproducible over many years. Such methods are of particular value for use in laboratories that lack the more advanced instruments. Classical methods fall into two main groups: qualitative analysis is used to find out what is present in a given substance; quantitative analysis deals with the procedures for determining how much of a substance is present in that substance.

Qualitative inorganic analysis. Cations (positive ions) are atoms or groups of atoms that are charged with positive electricity. Anions (negative ions) are atoms or groups of atoms that are charged with negative electricity. The identification of cations and anions is based upon the characteristic reactions that each type undergoes in solution. This means that in most instances the first important step in the analysis is dissolving any solid samples by treatment with water, acids, or bases. Once a suitable solution has been prepared, identification of the individual ions can be carried out by well-established chemical reactions.

The process of identification depends upon three main types of reactions. The first is the formation of colored precipitates. A precipitate is a substance separated out from a solution as a solid. This is done by treating the ions in solution with chemical reagents under specified conditions of acidity or alkalinity. Reagents are chemical substances that help identify other substances by the chemical reactions they cause. The second identification process is the development of characteristic colors in solution, usually as a result of using selective and highly specialized reagents. The third is the evolution of easily identified gases from the solution following reaction with acids, alkalis, or selective reagents.

Tests of this nature are frequently referred to as "spot tests." They may be carried out on a small volume of the sample solution placed in a slight depression on a glazed white tile. The tile surface provides an ideal background for viewing any color changes occurring in the solutions. Identification of any individual ion, however, depends on obtaining positive reactions with a range of several reagents. A single positive reaction can serve only to indicate identification. It is not in itself conclusive. Further confirmation is always necessary.

Qualitative inorganic analysis uses "wet chemistry" on a large or small scale. It depends on precipitating groups of metals out of a mixture as insoluble compounds. The diagram outlines the principle of the method for a mixture of 22 common metals. These metals would normally be in the form of their salts or other simple compounds. A sample is dissolved or suspended in water, and dilute hydrochloric acid IHCI) added. Any silver, mercury, or lead present is precipitated as the insoluble chloride. Hydrogen sulfide (H_2S) gas is bubbled through the remaining solution to precipitate the next group of metals as their sulfides. The solution is made alkaline with ammonium hydroxide (NH_4OH). A further group is precipitated as hydroxides. Then H_2S is again bubbled in,

precipitating another group of sulfides (this time from alkaline, not acid, solution). Finally, ammonium carbonate [INH_4) $_2C0_3$] is added to precipitate barium, calcium, and strontium as their carbonates. The only metals of the original mixture left in solution at this stage are potassium, magnesium, and sodium. The individual metals in each group are identified by specific tests. Some salts, such as phosphates, interfere with the method. They have to first be removed if they are present.

Qualitative organic analysis. The first steps in the identification of organic compounds are based upon physical tests. These include appearance, color, odor, and solubility. These tests are followed by determining either the melting point (of solid substances) or the boiling point (of liquids). By comparing these results with those in published tables, the analyst can rapidly narrow down the number of chemical possibilities. Further identification then follows a well-established procedure. The elements present in the compound are determined by decomposing it into inorganic substances. It is then established whether the compound is an acidic, alkaline, or neutral substance.

The preceding process is followed by a series of tests to determine the nature of the reactive groups in the compound. The tests are carried out on very small quantities of material. Many of these tests give rise to colored precipitates or solutions when a positive result is obtained. Once the substance has been provisionally identified, it may be confirmed by using one of a variety of other tests.

Quality control. One of the major uses of chemical analysis is in maintaining quality control in the chemical industry itself. The demand for purer chemicals and materials has led, in turn, to great improvements in analytical methods. As chemicals are manufactured, their rate of production is often checked automatically by on-line analytical equipment. The final material also undergoes rigorous tests. This ensures that it is the correct material and that it satisfies the specification for the quality required. Even minute amounts of impurities can cause it to be rejected as unsuitable.

Such quality control is of immense importance with chemicals that are used for human consumption or use, such as pharmaceuticals (drugs) and cosmetics. Even household products such as polishes, bleaches, detergents, and paints all require proper analytical checks to ensure that the correct amounts of chemicals have been mixed and that they are safe to use. In a similar way, the metals used to make such products as cars and aircraft must meet strict quality specifications. The presence of any impurities can cause corrosion to occur very rapidly. In this area, spectroscopic and surface analysis methods are of prime importance. Building materials (bricks, cement, and plaster) and adhesives are all substances that deteriorate rapidly if they are incorrectly made. Careful quality control is necessary to maintain high standards.

Chemical analysis is, therefore, an essential step in maintaining the quality of most of the products we use.

Vocabulary

Considerable – значний, важливий;
advance – поширення, розвиток, успіх;
reliable – надійний;
reproducible – відтворюваний;
undergo – зазнавати;
treatment – обробка;
acidity – кислотність;
alkalinity – лужність;
selective – відібраний;
precipitate – осідати;
insoluble – нерозчинний;
immense – величезний;
bleach – відбілювач;
detergent – миючий засіб;
tile – кахель;
rigorous – жорсткий;
adhesive - липкий

1. ***Read the text carefully and answer the following questions.***

a) What types of analysis can be performed on a given substance?
b) What do "classical methods" employ?
c) What is the difference between qualitative and quantitative analyses?
d) What is the identification of cations and anions based upon?
e) What does the process of identification depend on?
f) What tests are frequently referred to as "spot tests"?
g) What does the identification of any individual ion depend on?
h) What is qualitative inorganic analysis based on?
i) How do physical tests relate to qualitative organic analysis?
j) How is quality control motivated?

2. Explain the meaning of the underlined terms, or look them up in the explanatory dictionary.

3. Translate the following words and collocations into Ukrainian.

Qualitative analysis, quantitative analysis, identification, considerable advances, reliable and reproducible, of particular value, charged with positive electricity, in most instances, treatment with water, well-established chemical reactions, colored precipitates, selective and highly specialized reagents, on a glazed white tile, further confirmation, precipitating groups of metals, insoluble compounds, hydrochloric acid, insoluble chloride, hydrogen sulfide, ammonium hydroxide, specific tests, interfere with the method, melting point, boiling point, to narrow down the number of chemical possibilities, further identification, a well-established procedure, the preceding process, colored precipitates, maintaining

quality control, on-line analytical equipment, to undergo rigorous tests, of immense importance, pharmaceuticals, strict quality specifications, to occur very rapidly, building materials, adhesives, to deteriorate rapidly, to maintain high standards.

4.Translate the following words and collocations into English.

Якісний аналіз, подальше підтвердження, розчинні сполуки, перешкоджати методу, підтримувати контроль якості, кольоровий осадок, зменшувати кількість, температура кипіння, жорсткий контроль, встановлена процедура, зазнавати, хімічні можливості, визначення, у більшості випадків.

Make a sentence with each of them.

5. Continue the following sentences. Use the vocabulary from the text.

a. Qualitative analysis identifies …
b. Quantitative analysis measures …
c. Radiochemistry involves …
d. Many analyses are…
e. Classical methods fall into …
f. Cations are …
g. Anions are …
h. The process of identification depends on …
i. A precipitate is …
j. Reagents are …
k. The first steps in the identification of organic compounds are …
l. Quality control is …

6. Translate the following sentences into English. Use the vocabulary from the text.

a) Існує три типии аналізу в хімії.
b) Існує два види класичного аналізу.
c) Якісний аналіз застосовується для визначення різних типів елементів сполук наявних у речовині.
d) Утворення кольорового осадку – це перший тип реакції у процесі аналізу.
e) Хімічні речовини, які допомагають визначити якісний склад речовини, називаються реагентами.
f) Крапельна проба проводится з невеликою кількістю речовини.
g) Контроль якості дуже важливий у виготовленні медичних препаратів.

7. Make a plan of the text and give a summary to cover the topic 'Three types of analysis'.

8. Watch the video and describe the experiment shown in the video.

Unit 10

Chemical reaction

A chemical reaction is a process that leads to the transformation of one set of chemical substances. Classically, chemical reactions encompass changes that only involve the positions of *electrons* in the forming and breaking of *chemical bonds* between atoms, with no change to the nuclei (no change to the elements present), and can often be described by a *chemical equation*. *Nuclear chemistry* is a subdiscipline of chemistry that involves the chemical reactions of unstable and radioactive elements where both electronic and nuclear changes may occur.

The substance (or substances) initially involved in a chemical reaction are called *reactants or reagents*. Chemical reactions are usually characterized by a *chemical change*, and they yield one or more *products*, which usually have properties different from the reactants. Reactions often consist of a sequence of individual sub-steps, the so-called *elementary reactions*, and the information on the precise course of action is part of the *reaction mechanism*. Chemical reactions are described with chemical equations, which graphically present the starting materials, end products, and sometimes intermediate products and reaction conditions.

Chemical reactions happen at a characteristic *reaction rate* at a given temperature and chemical concentration, and rapid reactions are often described as spontaneous, requiring no input of extra energy other than thermal energy. Non-spontaneous reactions run so slowly that they are considered to require the input of some type of additional energy (such as extra heat, light or electricity) in order to proceed to completion *(chemical equilibrium)* at human time scales.

Different chemical reactions are used in combinations during *chemical synthesi*s in order to obtain a desired product. In *biochemistry*, a similar series of chemical reactions form *metabolic pathways*. These reactions are often *catalyzed* by protein *enzymes*. These enzymes increase the rates of biochemical reactions, so that metabolic syntheses and decompositions impossible under ordinary conditions may be performed at the temperatures and concentrations present within a *cell*.

The general concept of a chemical reaction has been extended to reactions between entities smaller than atoms, including *nuclear reactions*, *radioactive decays*, and reactions between *elementary particles* as described by *quantum field theory*.

1. Answer the following questions to check your comprehension of the text.

1. What changes do chemical reactions encompass?
2. What is *nuclear chemistry*?
3. What are the reagents?
4. What do chemical reactions often consist of?
5. When do chemical reactions happen?
6. What is the difference between spontaneous and non-spontaneous reactions?
7. What happens during chemical reactions in biochemistry?
8. How has the general concept of a chemical reaction been extended?

2. State the following sentences as true(T) or false(F).

1. The changes that occur during chemical reactions do not modify the nuclei.
2. Chemical reactions lead to decomposition of chemical bonds between atoms.
3. Electronic and nuclear changes rarely occur during chemical reactions in nuclear chemistry.
4. Chemical reactions result in chemical change.
5. Reactions often consist of elementary reactions.
6. Rapid reactions are often described as non-spontaneous.
7. In order to obtain a desired product different chemical reactions are used.
8. The general concept of a chemical reaction has never been improved.

3. Explain the meaning of the highlighted terms, or look them up in the explanatory dictionary.

4. Find appropriate matches to form phrases.

1.metabolic…….	6. radioactive …….
2. ……rate	7. ……. decays
3……. bonds	8. intermediate …….
4…… equation	9. biochemical…….
5. spontaneous……	10. thermal…….

5. Make a sentence with each of them.

6. Match the opposites.

1. general	a) decrease	6. completion	f) finally
2. ordinary	b) slow	7. change	g) beginning
3. spontaneous	c) stability	8.elementary	h) well-planned
4. rapid	d) definite	9. increase	i) unique
5. decay	e) composition	10. initially	j) complicated

7. Match the synonyms.

1. occur	a) happen	6. properties	f) features
2. sequence	b) succession	7. nuclear	g) atomic
3. reagent	c) reactant	8. additional	h) supplementary

4. input	d) contribution	9. obtain	i) gain
5. encompass	e) include	10. rate	j) speed

8. Fill in the gaps with the given words.

unstable breaking sequence spontaneous non-spontaneous metabolic pathways reactants

1. Nuclear chemistry is a sub-discipline of chemistry that involves the chemical reactions of ……. and radioactive elements.
2. Chemical reactions encompass changes that only involve the positions of electrons in the forming and …….of chemical bonds between atoms.
3. Reactions often consist of a …… of individual sub-steps.
4. Rapid reactions are often described as …… .
5. …….. reactions run so slowly that they are considered to require the input of some type of additional energy.
6. In biochemistry, a similar series of chemical reactions form ……. .
7. The substance (or substances) initially involved in a chemical reaction are called ……. or reagents.

9. Write a summary of the text.

10. Retell the text according to your summary.

11. Watch the video and answer the questions

What is a chemical reaction?

Describe the reactions you have seen in the video.

Unit 11

THE ENVIRONMENTAL SITUATION

The high levels of industrial and agricultural concentration are responsible for a rather complicated ecological situation that has taken shape in Ukraine. The most unfavorable is the Donetsk-Trans-Dnipro region where a lot of mining metallurgical and chemical enterprises are operating.

As a result of the Chornobyl nuclear power plant disaster of 1986, the environmental situation has become much worse. Apropos of this Ukraine appealed to the UNO requesting help to overcome the disaster aftermath.

The Environmental Protection Law well in compliance with international standards in this field has been in force since 1991. Environmental safeguards of conservation bodies have become more stringent. Ecological monitoring has covered Ukraine's whole area and the Extraordinary Governmental Commission on the Problems of the Dnipro and Upgrading the Quality of Drinking Water has been set up. Ukraine has actively joined international cooperation in the field of environmental protection. Agreements have been signed with conservation bodies of the USA, Poland, Slovakia, Germany, and Latvia. The Ukrainian delegation took part in the UNO Conference on the Problems of Environment in Rio de Janeiro.

Ukraine enters a new phase of its history with intentions to create a democratically minded, law-based; independent society. Ukraine is looking for its place in European House, in the civilized world going to its aim unswervingly.

Environmental protection is a global problem. The activity of various environmental organizations helps to improve the situation. Among them are the Green peace and The Green Party. Our authorities should take care about nature and do everything to protect it. For example, provide special filters on factories to reduce the pollution of rivers and air, recycle the used paper plastic and glass; reduce the usage of electricity. To improve the situation both individuals and government should work together. People should change their habits and behavior. They should use more public transport. Rolling and biking should be popularized.

1. Answer the following questions to check your understanding of the text.

1. What are the reasons for rather complicated ecological situation that has taken shape in Ukraine?
2. What do you know about Chornobyl nuclear power plain disaster?
3. What countries have agreements with conservation bodies been signed with?
4. What measures in your opinion should be undertaken to overcome ecological situation that has taken shape in Ukraine?
5. What is the ecological situation in your city?
6. What are the possible ways to control and improve environmental situation?

2. Find Ukrainian equivalents for the following English words.

Mining, disaster, apropos of smth, to appeal, to overcome, aftermath, in compliance with, conservation bodies, stringent, unswervingly, to reduce.

3. ***In what line of the text do you read.***

1. That, the most unfavorable is the Donetsk-Trans-Dnipro region.
2. That Ukraine appealed to the UNO requesting help to overcome the disaster aftermath.

3. That, Environmental safeguards of conservation bodies have become more stringent.
4. That, Ukraine has actively joined international cooperation in the field of environmental protection.
5. That, Ukraine enters a new phase of its history.
6. Mutual initiatives should be taken to improve environmental situations.

4. Find English equivalents for the following.

Несприятливий, очищувати, навколишнє середовище, їжа, безпечний, забруднення, сміття, чиста вода, вмирати, жива природа, ядерна енергія, сонячна енергія.

5. Translate the following sentences.

1. The problem concerned is known to be the most difficult one.
2. Having investigated the properties of this polymer they come to a definite conclusion.
3. The experiment being very important, we paid special attention to the product obtained.
4. The problem of environmental protection is very important, a special committee having been set up under the U.N. organization.
5. The development of modern industry is likely to be accompanied by the development of waste less production.
6. Concentration of CO happens to be rather high in air.
7. Primitive man appeared to disturb the balance of nature by farming and cattle breeding.
8. Ultraviolet radiation from the Sun seems to make the evaporation of some substances from trees and Earth's crust to react with atmospheric oxygen.

6. Give opposites of the following words.

Associate, definite, man-made, rare, giant, primitive, natural, indefinite, dissociate, frequent, developed, small.

7. Write down the synonyms for the following words.

Common, few, to begin, to cause, device, to emit, to maintain, toxic, to start, little, usual, to give rise to, instrument, to evolve, to support, noxious.

8. Translate the following sentences. Be sure that you know the meaning of the following words.

cause - причина; визивати, спричиняти; примусити.
for - для, протягом, тому що

1.Carbon monoxide causes the pollution of air. 2. Automobile exhaust gases are the cause of increasing CO concentration in air. 3. Industrial activity is known to cause noticeable effect on a global scale. 4. At high concentration sulphur oxides are the causes of vegetation disbalance. 5. The initiative of "Green Peace"

movement caused the world public to pay special attention to the problem of environmental protection. 6. For many centuries the problem of air pollution was not paid attention to. 7. We ought to protect the environment for it is in danger of human activity. 8. Industrial enterprises must use filters for exhaust gases to be purified. 9. They investigated carbon monoxide and sulphur oxide for the reason of their toxic properties. 10. The experiment lasted for three hours. 11. The ecosystem has a definite role to play for an overall balance has to be maintained.

9. Give English equivalents for the words in brackets. Be sure that you understand the text.

A few years ago, the average person would not have had the slightest idea of this term. Today, the word is (на вустах кожного). The man in the street usually associated it with the effect of pollution and our efforts to (очищення). According to the definition of a biologist, on the other hand, ecology is the study of plants, and animals in relation to their environment. A (суспільство) of plants and animals within a particular habitat is called ecosystem. Every plant or animal of an ecosystem has a definite role to play to maintain (спільний баланс) in the system. This role is referred to as ecological niche. Man-made pollution frequently alters the environment in which a community of organisms lives and upsets its delicate balance. It is of significance that pollution produces numerous (несприятливий) effects (крім) disturbing ecosystem.

(Людина), of course, is a part of the world ecosystem. In primitive societies based on hunting and food gathering, he fitted in quite well, he ate roots and (ягоди) or trapped animals for food. He began to seriously (турбувати) the balance of nature only after he started to practice farming on a large scale and keep a sizeable herd of grass-eating animals.

In recent years, it is the growth of giant cities accompanied by industrial development on a huge scale that has begun to introduce enormous amounts of noxious wastes into (навколишнє середовище). Our transportation devices are likewise serious offenders in this regard as are the numerous new synthetic materials such as plastics that soil and water bacteria cannot degrade.

12. Make a plan of the text and give a summary to cover the topic.

13. Watch the video "Top 10 Major Global Environmental Issues In The World - List Of Global Environmental Problems [2021]" and answer the questions.

1. When was global plan of action adopted?
2. How many people believe that climate change is a global concern?
3. Describe the 10 top global issues of today.

Unit 12

LABORATORY EXPERIMENTS

In chemistry, as in other sciences, the study of any phenomenon begins first of all with observation and description of the phenomenon. But science does not confine itself only to description of observed phenomena; its most important task is to explain them. In seeking to explain phenomena we strive to delve ever deeper into their essence, to ascertain their causes, to establish the conditions under which they occur. For this purpose, we reproduce various phenomena artificially, under conditions and in an environment best adapted for their study. The artificial reproduction of a phenomenon is called an experiment. Experiments are mostly intended to check the truth of ideas or assumptions which arise in studying a phenomenon. Assumptions put forth to explain a phenomenon, to establish its connection with other phenomena studied earlier, to unite several phenomena under a common idea, are called hypotheses. If the conclusions which follow logically from the assumption made are confirmed by experiment, if the hypothesis explains not only the phenomenon in question, but permits general conclusions and prediction of new phenomena as well, the hypothesis becomes a theory. If, on the other hand, experiment fails to confirm it, the hypothesis must be discarded.

Theory, which is a broad generalization of experience, greatly facilitates the study of phenomena, enables us to understand them better. Moreover, it points out the trend of further experiments and gives hints for carrying them out, and therefore has an instructive value. Theory makes it possible to carry on investigations without groping in the dark, according to a prearranged plan, from a definite standpoint and on the basis of established laws. Especially important theoretical generalizations in chemistry, which have made for progress in this branch of science, are: the theory of atoms and molecules, the theory of chemical structure, the Periodic Law and the periodic system of chemical elements.

Vocabulary

phenomenon (pl. phenomena) – феномен, явище
to confine – обмежувати(ся)
to strive (strove, striven) – прагнути, переслідувати ціль
to delve – занурюватися
to ascertain – з'ясовувати
to occur – траплятися, відбуватися
artificially – штучно
intended – тут: спрямовані, направлені

assumption – припущення
put forth – використовувати
in question – про який іде мова, названий вище
discarded – відкинутий
to facilitate – полегшувати
to enable – давати можливість
groping in the dark – навпомацки

1. Read the text carefully and answer the following questions.

1. What does the study of any phenomenon begin with?
2. What is the most important task of science?
3. What do scientists do to explain phenomena?
4. What is an experiment?
5. What is the purpose of an experiment?
6. What is a hypothesis according to the text?
7. When does a hypothesis become a theory?
8. Does a hypothesis always become a theory?
9. What are the functions of theory?
10. What important theoretical generalizations in chemistry are mentioned in the text?

2. Explain the meaning of the underlined terms, or look them up in the explanatory dictionary.

3. Find and write down all nouns from the text used in singular form. Then supply the plural form for each of them.

4. Give synonyms for the following words.

Study (n), to begin, to confine, task, to seek, to delve, to ascertain, to occur, purpose, to arise, to establish, to unite, to permit, trend, progress, branch.

5. Give opposites for the following words.

To begin, to fail, to enable, to permit, to unite, to establish, generalization, progress.

6. Translate the following words and collocations into Ukrainian.

Description of the phenomenon, first of all, observed phenomena, strive to delve, to ascertain their causes, to establish the conditions, for this purpose, to reproduce, phenomena, artificially, under conditions, the artificial reproduction of a phenomenon, to check the truth of ideas, phenomena studied earlier, under a common idea, to follow logically, the phenomenon in question, to permit prediction, on the other hand, a broad generalization, to facilitate greatly, moreover, to point out the trend, to give hints, therefore, an instructive value, without groping in the dark, according to a plan, from a definite standpoint, established laws, the periodic system.

7. Translate the following words and collocations into English. Then make a sentence with each of them.

Значно полегшувати, з цією метою, встановлювати умови, прагнути дослідити, певна точка зору, перш за все, умова, більш того, відмічати тенденцію, перевіряти правдивість тверджень, відовідно з планом, узагальнення.

8. Continue the following sentences. Use the vocabulary from the text.

1. The study of any phenomenon begins ……
2. The most important task is …….
3. The artificial reproduction of a phenomenon ……
4. Experiments are……
5. If the conclusions are confirmed by experiment……
6. If the experiment fails to confirm ……
7. Theory makes it possible……
8. Especially important theoretical generalizations in chemistry……

9. Translate the following sentences into English. Use the vocabulary from the text.

a) Теорія дає можливість проводити дослідження.

b) Вчені прагнуть проникнути в суть явищ та пояснити їх з наукової точки зору.

c) Новітні технології полегшують проведення експериментів.

d) Штучно створені умови допомагають проводити дослід у лабораторіях.

e) Елемент, про який іде мова, був причиною такої зміни кольору речовини.

f) Що називається теорією з наукової точки зору?

10. Make a plan of the text and give a summary to cover the term 'Laboratory Experiments'.

11. Watch the video and do the following:

1.Name the equipment or laboartory experiments.
2.Describe the procedure of the first experiment.
3.Describe the procedure of presipitation of barium sulfate
4.Describe the procedure of recrystallization.

GRAMMAR

1. Form plural nouns.

A lesson, a circle, a photo, society, an example, a textbook, mass, a box, a key, a woman, a knife, a man, a country, a child, a wolf.

***2.* Name the lines in which all the nouns have only.**

a) the singular form; b) the plural form.

1. sale, stuff, commodity, money, profit, equipment, difficulty, waste, employment.
2. thanks, shortcomings, the poor, valuables.
3. knowledge, news, production, advice.
4. scales, scissors, glasses, goods, clothes, arms, shorts.
5. information, news, hair, vacation, genetics, physics.

3. Choose the right tense form of the verb.

1. Look! They ___ the bridge.
a) are repairing b) were repairing c) will be repairing
2. At 2 o'clock tomorrow they ___ a letter.
a) are writing b) will be writing c) were writing
3. We ___ a book when Tom came.
a) are discussing b) were discussing c) will be discussing
4. Right now she ___ the exam.
a) is taking b) will be taking c) was taking
5. Tomorrow I ___ the whole day.
a) was reading b) am reading c) will be reading
6. The delegation ___ tomorrow.
a) is coming b) will be coming c) was coming
7. Yesterday it ___ the whole evening.
a) is raining b) will be raining c) was raining
8. Excuse me! I ___ for a post office. Can you help me?
a) was looking b) will be looking c) am looking
9.___ you ___ German lesson now?
a) were ___ taking b) will ___ be taking c) are ___ taking
10. Tomorrow from 5 till 7 I ___ TV.
a) am watching b) was watching c) will be watching

4. Below are the sentences in the Present Simple Tense. Rewrite each one in Present Continuous, Past Continuous and Future Continuous.

1. She works in an analytical laboratory.
2. We prepare for students' scientific conference.
3. We dissolve sodium crystals in water.
4. They work with an electron microscope.
5. We watch an automatic sample analyzer.

5. Open the brackets and choose the correct form of the verb.

1. We (are, were) in the laboratory of inorganic chemistry now.
2. We (watch, are watching) reactions of neutralization.
3. Usually a base and an acid (interact, are interacting) in this type of reaction.
4. At the moment we (observe, are observing) how hydrochloric acid (is reacting, reacts) with NaOH.

5. In neutralization reactions a salt and water often (form, are forming).
6. When we (came, were coming) to the laboratory students (prepared, were preparing) for the seminar.
7. I (am working, work) in the library from 3 to 6 p.m. tomorrow.
8. I (go, am going) to the library right now.
9. They (discussed, were discussing) a plan of their experiment at that time yesterday.
10. They (are going, will be going) to speak about new biologically active compounds at the conference at the end of the week.

6. Choose the correct tense form of the verb.

1. Yesterday the whole evening they ___ TV.
a) will be watching b) are watching c) were watching
2. Do not disturb him. He ___ now.
a) is working b) was working c) will be working
3. I ___ the book at the moment.
a) am translating b) was translating c) will be translating
4. We are busy now. We ___ through the papers.
a) were looking b) will be looking c) are looking
5. What ___ you ___ at this time tomorrow?
a) are ___ doing b) were ___ doing c) will ___ be doing
6. She ___ tomorrow.
a) is coming b) was coming c) will be coming
7. ___ you ___ to Brown's lecture today?
a) are ___ going b) were ___ going c) will ___ be going
8. When I came home yesterday my family ___ tea.
a) is drinking b) will be drinking c) were drinking
9. Do not go out. It ___ hard.
a) was raining b) is raining c) will be raining
10. She ___ the picture yesterday when I came.
a) is painting b) will be painting c) was painting

7. *Open the brackets using the active form of Simple, Continuous and Perfect Tenses.*

1. Though he (to take) aspirin, he was still running a high temperature.
2. At the chemist's department I (to buy) pills and powders right away and (to order) the cough mixture at the prescription department.
3. She (to suffer from) respiratory insufficiency since childhood.
4. He cut his finger when he (to prepare) food.
5. Before he died he (to undergo) three courses of chemotherapy.
6. I (to work) tonight so I (to be tired) tomorrow.

8. Translate into English.

1. Вчора студенти цілий день готувались до наукової конференції по хімії.
2. Коли приїжджає делегація?
3. Що Ви робите?
4. Коли ми зайшли до лабораторії, студенти готувались до семінару.
5. Завтра о 2 годині вони будуть обговорювати результати експерименту.
6. Зараз ми знаходимось в лабораторії органічної хімії.
7. Дослідники збираються вивчати властивості деяких мінералів.
8. В даний момент студенти спостерігають за реакцією речовин.
9. Студенти проводять зараз експеримент.
10. Студенти беруть участь у конференції, яка відбувається в інституті.

Tense Review

1. Use any appropriate tense of the verbs in parentheses.

1. John is in my Chemistry class. He *(study)* _____Chmistry this semester. He *(take, also)* _____some other classes. His classes *(begin)* ___at 9:00 every day.
2. Yesterday John ate breakfast at 8:00. He *(eat, already)* _____ breakfast when he *(leave)* ___for class at 8:45. He *(eat, always)* ____breakfast before he *(go)* ____to class. Tomorrow before he *(go)* ____to class, he *(eat)* _____ breakfast.
3. John is in class every morning from 9:00 to 12:00. Two days ago, I *(call)* ___ him at 11:30, but I could not reach him because he *(attend)* _____class at that time.
4.Don't try to call John at 11:30 tomorrow morning because he *(attend)* ___class at that time.
5.Yesterday John took a nap from 1:00 to 2:00. I arrived at 1:45. When I *(get)*____there, John *(sleep)* _____. He *(sleep)*_____for 45 minutes by the time I got there.
6. Right now John *(take)* _____a nap. He *(fall)* _____asleep an hour ago. He *(sleep)* ___for an hour.
7. Three days ago, John *(start)* ___to read *A Farewell to Arms*, a novel by Ernest Hemingway. It is a long novel. He *(finish, not)* ____reading it yet. He *(read)* _____it because his English teacher assigned it.
8. Tomorrow, after he *(eat)* _____dinner, John *(go)* _____to a movie. In other words, he *(eat)* _____dinner by the time he *(go)* ____to the movie.
9. Since the beginning of the semester, John *(read)* _____three novels. Right now he *(read)* _____*A Farewell to Arms.* He *(read)* _____that novel for the past three days. He *(intend)* _____to finish it next week. In his lifetime, he *(read)*_____many novels, but this is the first Hemingway novel he *(read, ever)* _____.

2. Complete the following sentences with the correct tense of the verbs in parentheses.

1. Daryl always *comes* (come) to work on time.
2. Mr. Jones_____(teach) us at present. He____(substitute) for Mr. Holt, who is our regular teacher.
3. I____(work) in my garden when you called me last night.
4. We____(take) our finals next week.
5. I____(come) to work on the bus this morning.
6. As I___(come) to work this morning, I_____(meet) a boy who_____(try) to sell me a watch.
7. I____(be) to the Grand Canyon several times.
8. Listen! I think the telephone_____(ring).
9. Bob said that he_____(see) that movie before.
10. I_____(read) that novel three or four times.
11. By this time next year, we____(complete) all the exercises in this book

3. Form nouns from the following verbs.

To begin, to speak, to think, to examine, to listen, to read, to invent, to divide, to represent, to classify, to certify, to notify, to identify.

4. Form verbs from the following nouns.

Separation, occupation, development, contribution, dictation, information, examination, production, worker, meeting, collection, beginning.

5. Use the prefix 'self' to form English equivalents of the words given below.

Defence, service, government, expression, esteem, control, discipline, love, protection, respect, improvement, devotion.

6. ***From verbs from the following adjectives.***

Hard, weak, deep, soft, identical, simple, intense, special, real, crystal, general.

7. Give the nouns from which the following adjectives are derived.

Successful, central, effective, natural, medical, scientific, responsible, environmental, vibrational, conditional, valuable.

8. State whether the Present Perfect or Past Perfect or Future Perfect best completes each sentence.

1. Scientists of an analytical laboratory (to perform) already qualitative determination on some new compounds.
2. She never (to work) with noble glasses.
3. We (to finish) all our calculations by May.
4. When a laboratory assistant (to come) students (to clean) already their benches.
5. They (to finish) just our experiment.
6. I (to translate) the article about Chemistry before I (to pass) my exam.
7. Before I (to enter) the University I (to work) at the construction site.
8. Tomorrow by 1 o'clock all of them (to pass) already their exam in Chemistry.

9. By the end of this academic year we (to finish) our research.
10. …you ever (to be) at this laboratory?

9. Open the brackets.

1. They already (to pass) their exams.
2. He (to graduate) from the Institute this year.
3. What Institute he (to enter)?
4. He (to find) all the necessary material before he (to begin) working at his report.
5. I (to work) at the laboratory for 3 hours yesterday.
6. What you (to do) here?
7. We (to study) solubility of these solids at the previous lesson.
8. At that time researches (to pay) much attention to solubility studies.
9. Analysts usually (to perform) quantitative analysis before qualitative one.
10. Many towns of our country (to become) industrial and cultural centers.

Conditional Sentences.

1. Translate the following sentences.

1. If the experiment is successful, the results will be accurate.
2. Provided the temperature was high, the metal would melt.
3. Unless metals had been good conductors, they wouldn't have been used in many branches of industry.
4. If non-metals hadn't borrowed electrons, they would not have combined.
5. Unless metals (lent, had lent) electrons they wouldn't have combined with non-metals and formed salts.
6. Provided we (got, have got) good results in our experiment, we should take part in the discussion.
7. If he (had known, knew) the problem better, he wouldn't have made a mistake in his experiment.
8. Unless she (were, had been) too busy tonight, she would have met with them.

2. *Put the verb in the correct form.*

1. If you (not to buy) coffee, we will drink tea.
2. If he is free tomorrow, he certainly (to come) to our party.
3. My brother would not have missed many lessons if he (not to hurt) his leg.
4. If friend (to work) in my office, we should meet today.
5. If you spoke English every day, you (to improve) your language skills.
6. If you get an "excellent", your mother (to be) happy.
7. If she (to return) earlier, she would have been able to see him before he left.
8. If these shoes were not too big for me, I (to buy) them.
9. If you (to ring) me up, I will tell you a secret.
10. If you (to be) a poet, you would write beautiful poetry.
11. If he did not read so much, he (not to know) English literature so well.
12. If he (to come) to our house yesterday, he would have met his friend.

3. Write a sentence with If... for each situation.

1.We don't visit you very often because you live so far away.

If you didn't live so far away, we'd visit you more often.

2. He doesn't speak very clearly that's why people don't understand him.

3. If he …… more, people .....

4. That too expensive, so I'm not going to buy a book.

5. If the book ……, I ……....

6. We don't go out very often because we can't afford it.

7. It's raining, so we can't have lunch in the garden.

8. I have to work tomorrow evening, so I can't meet you.

Interrogative sentences

General questions

1. Write questions from these words. Use is/can

1. (matter composed of atoms?)
2. (valence of an atom determined by the number of electrons?)
3. (reduction accompanied by an algebraic increase in valence?)
4. (the chemical properties be explained by the structure of the atom?)
5. (the activity of metals related to the size of the atom?)

2. Write questions with Do/Does….?

1. I want to be famous. And you?
2. I like nice weather. And you?
3. I play tennis. And you?
4. I speak English. And Dmytro?
5. I know the answer. And Olga?
6. I smoke. And he?

3. Write questions from these words. Use have/has

1. (you / a camera?)
2. (how much money / you?)
3. (you / a passport?)
4. (your father / car?)
5. (Ann / black hair?)
6. (Dmytro / a bicycle?)

Special questions

1. Make question with *what, where, how.*

1 ……. is matter composed of ?

2 ……..is the atom?

3 …….do you know about electrons, protons, neutrons?

4 ……..is the mass of the atom concentrated?
5 ……..is the valence determined?
6 ……..process produces covalent compounds?

2. Put in *what/which/who.*

1. …….is that man's name?
2. ……..way shall we go?
3. …….do you want?
4. ……..colour is it?
5. ……..is older, Ann or Joe?
6. …….room is yours?

3. Write questions.

1. I want to go. (Where……..?)
2. Dave and Mary are going away. (When…….?)
3. He is going to stay here. (How long……?
4. I can't come to the party. (Why…….?)
5. I need some money. (How much……?
6. It rains a lot. (How often……?)

The Active and Passive Voice

1. Complete the sentences with the given words.

is composed	are being introduced
were investigated	were being studied
have been used	have been overcome
will be discussed at	will have been done

1. Matter…….. of atoms.
2. A wide range of computers ……. into practice.
3. New methods obtaining polymers…….at our plant.
4. Many properties of compounds…….at the end of the eighteenth century.
5. Their data ……by our group for a week.
6. Many difficulties…… by the researcher in his work.
7. His report …….. the conference.
8. This work …….. by 7 p.m.

2. Translate the sentences. Be sure that you know the forms of Passive Voice.

2. Oxidation *is accompanied* by an algebraic increase in valence.
2. In the first year we *are taught* chemistry, structure of matter, higher mathematics, etc. We *are* also *given* laboratory works to do.
3. The valence or combining capacity of an atom *is determined* by the number of electrons it gains, loses or shares in chemical combinations of atoms of other elements.

4. The Law of Constant Composition *was* first definitely *stated* by John Dalton in 1804.
5. All the instruments *were looked* at with great interest.
6. By the end of the eighteenth century the terms "element" and "compound" *were* generally *accepted.*
7. Is this true that this problem *will be investigated* in our laboratory?
8. His scientific paper *will be presented* at the conference and we *shall be invited* to the discussion of it.
9. All the data *will be analyzed* by the experimenter himself.

3. Insert the correct form of the verb given in brackets.

1. The importance of nitrogen (to speak about).
2. The discovery of Robert Brown (to think of) as one of the greatest discoveries of his time.
3. A new method (to present) in his report.
4. The chief engineer (to send for) immediately.
5. His results may (to rely upon).

4. Complete the sentences.

This magazine	will be translated	with a lot of pictures.
Those high buildings	will be built	from a distance.
Scientific reports	was published	in our magazine.
The article	were discussed	with a lot of diagrams.
Some questions	were read	yesterday.
All these stories	were built	with great interest.
A lot of new schools	is illustrated	last year.
Some articles	are seen	by him.
All these houses	are published	very soon.

5. Put the verb into the correct form, present simple or past simple, active or passive.

1. It's a big factory. Five hundred people *are employed* (employ) there.
2. Water……(cover) most of the Earth's surface.
3. Most of the Earth's surface ..... (cover) by water.
4. The park gates ..... (lock) at 6.30 p.m. every evening.
5. The letter……. (post) a week ago and it……. (arrive) yesterday.
6. The boat……. (sink) quickly but fortunately everybody ……. (rescue).
7. Ron's parents……(die) when he was very young. He and his sister……. (bring) up by their grandparents.
8. I was born in London but I……. (grow) up in the north of England.
9. While I was on holiday, my camera……(steal) from my hotel room.
10. While I was on holiday, my camera……. (disappear) from my hotel room.
11. Why……. (Sue/resign) from her job? Didn't she enjoy it?
12. Why……. (Bill/sack) from his job? What did he do wrong?

13. The company is not independent. It……. (own) by a much larger company.
14. I saw an accident last night. Somebody……(call) an ambulance but nobody……. (injure) so the ambulance……. (not/need).
15. Where……. (these photographs/take)? In London? ……(you/take) them.

Modal Verbs

1. Insert the correct form of* may/might *(*be allowed to*).

1. It . . . rain, you'd better take a coat.
2. He said that it. . . rain.
3. We ... as well stay here till the weather improves.
4. ... I borrow your umbrella?
5. You . . . tell me! (*I think I have a right to know.)*
6. Candidates . . . not bring textbooks into the examination room.
7. ... I come in? ~ Please do.
8. When he was a child he . . . *(they let him)* do exactly as he liked.
9. He ... be my brother *(admit that he is)* but I don't trust him.
10. I . . . never see you again.
11. He ... be on the next train. We ... as well wait.
12. If we got there early we . . . get a good seat.
13. The police . . . *(have a right to)* ask a driver to take a breath test.

2. Fill the spaces in the following sentences by inserting* must *or the present, future, or past form of* have to*.

1. She . . . leave home at eight every morning at present.
2. Notice in a picture gallery: Cameras, sticks and umbrellas ... be left at the desk.
3. He sees very badly; he . . . wear glasses all the time.
4. I... do all the typing at my office.
5. You . . . read this book. It's really excellent.
6. The children . . . play in the streets till their mothers get home from work.
7. She felt ill and . . . leave early.
8. Mr Pitt. . . cook his own meals. His wife is away.
9. I hadn't enough money and I . . . pay by cheque.
10. I never remember his address; I always . . . look it up.
11. Employer: You . . . come to work in time.
12. If you go to a dentist with a private practice you . . . pay him quite a lot of money.
13. Father to small son: You ... do what Mummy says.
14. My neighbour's child . . . practise the piano for three hours a day.
15. Doctor: I can't come now.
    Caller: You . . . come; he's terribly ill.
16. English children . . . stay at school till the age of 16.
17. In my district there is no gas laid on. People . . . use electricity for everything.
18. Notice above petrol pump: All engines ... be switched off.

19. Mother to daughter: You . . . come in earlier at night.
20. The shops here don't deliver. We . . . carry everything home ourselves.
21. The buses were all full; I . . . get a taxi.
22. Notice beside escalators: Dogs and push chairs ... be carried.
23. 'Au pair' girls usually ... do quite a lot of housework.
24. Tell her that she ... be here by six. I insist on it.
25. When a tyre is punctured the driver . . . change the wheel.
26. Park notice: All dogs ... be kept on leads.

3. Fill the spaces in the following sentences by using* <u>must</u>, <u>can't/couldn't</u> or <u>needn't</u> + *the perfect infinitive of the verbs in brackets.

1. Did you hear me come in last night? ~ No, I . . . (be) asleep.
2. I wonder who broke the wineglass; it. . . (be) the cat for she was out all day.
3. You . . . (help) him. *(You helped him but he didn't need help.)*
4. I had my umbrella when I came out but I haven't got it now. ~ You . . . (leave) it on the bus.
5. He . . . (escape) by this window because it is barred.
6. I ... (give) £10. £5 would have been enough.
7. I saw a rattlesnake near the river yesterday. ~ You . . . (see) a rattlesnake. There aren't any rattlesnakes in this country.
8. He is back already. He . . . (start) very early.
9. He returned home with a tiger cub. ~ His wife (be) very pleased about that.
10. I bought two bottles of milk. You . . . (buy) milk; we have heaps in the house.
11. I left my bicycle here and now it's gone. ~ Someone . . . (borrow) it.
12. When she woke up her watch had vanished. ~ Someone . . . (steal) it while she slept.
13. I've opened another bottle. ~ You . . . (do) that. We've only just started this one.
14. The machine said, 'You weigh 65 kilos,' and I said, 'Thank you.' ~ You . . . (say) anything.
15. I told him to turn left and he immediately turned right! ~ He . . . (understand) you.
16. Perhaps he swam across. ~ No, he . . . (do) that; he can't swim.
17. Do you remember reading about it in the newspapers? ~ No, I . . . (be) abroad at the time.
18. He . . . (walk) from here to London in two hours. It isn't possible.
19. He was very sick last night. ~ The meat we had for supper . . . (be) good.
20. There was a dock strike and the liner couldn't leave port. ~ The passengers . . . (be) furious.
21. We went to a restaurant and had a very good dinner for £3. ~ You . . . (have) a very good dinner if you only paid £3.
22. I have just watered the roses. ~ You . . . (water) them. Look, it's raining now!
23. That carpet was made entirely by hand. ~ It . . . (take) a long time.
24. The door was open. ~ It . . . (be) open. I had locked it myself and the key was in my pocket.

25. He came out of the water with little red spots all over his back. ~ He . . . (be) stung by a jelly-fish.

Part 2

Освітня програма “ Фармація, промислова фармація ”

Unit 1

Sulphuric Acid

Sulphuric acid is a heavy colourless liquid which forms a constant boiling solution containing 98.33 per cent sulphuric acid. The boiling of such a solution is 338°. Having been heated such a solution dissociates, yielding sulphur trioxide in water.

One has to take into account that sulphuric acid has a great affinity for water, with which it unites with great evolution of heat. For this reason, the acid when it is to be diluted with water must always be poured gradually into an excess of water. One should not proceed in the reverse manner, i.e. to pour the water into acid, for the great amount of suddenly liberated is certain to lead to explosions throwing the acid out of the container.

On the over hand, this affinity for water makes sulphuric acid one the best drying agents for gases it does not react chemically with. Some of them when heated with sulphuric acid contain less moisture than otherwise.

When the concentrated acid is poured into water the liberation of heat indicates that the acid reacts with water to form hydrates. From the general properties of oxy acids, we might expect that sulphuric acid is much stronger than sulphurous acid and this is really the case.

Sulphuric acid as ordinarily used in laboratory practice, may be both rather dilute and very concentrated.

An aqueous solution of sulphuric acid has the properties of moderately strong, dibasic acid. If dilute, the solution reacts with metals above hydrogen in the electrochemical series to liberate hydrogen but a concentrated solution reacts as an oxidizing agent with many metals both above and below hydrogen forming sulphates and usually liberating sulphur dioxide.

It should be noted, however, that some metals-lead, for example-dissolve more readily in concentrated acid than in dilute, because their sulphates are more soluble in solutions containing higher concentrations of acids.

Concentrated acid is an active oxidizing agent when heated.

Sulphuric acid, being produced on a large scale, is more extensively used in industry than any other manufactured compound. It is by far the most widely used acid. Enormous quantities of sulphuric acid are consumed in industry, and the largest amount is used in the manufacture of fertilizers and in refining petroleum.

1. Words and word-combinations to be remembered.

affinity – спорідненість
aqueous – водний
below – нижче, під
dibasic – двохосновний
to dilute - розбавляти
drying agent – висушувач
enormous – величезний
gradually – поступово
to liberate – вивільняти
moisture – волога
to pour – лити, наливати
sulphur – сірка
sulphuric – сірчана кислота
sulphuric acid – сірчаниста кислота
yield – вихід, давати
for this reason – з цього приводу
to take into account – брати до уваги
in this case – в цьому випадку
to dissociate – відділяти від, розпадатись
explosion – вибух

2. Answer the following questions.

1. What are the properties of sulphuric acid?
2. Which acid is stronger, sulphuric or sulphurous?
3. What can you say about aqueous solutions of sulphuric acid?
4. Why can't one pour water into sulphuric acid?
5. Is sulphuric acid used only in laboratory or in industry as will?
6. Which acid is one of the most widely used?
7. Why do some metals dissolve more readily in concentrated acid than in dilute?
8. What can you say about the concentrated acid?

3. Read the text and mark the following statements as true (T) or false(F).

1. Sulphuric acid is a heavy coloured liquid.

2. The solution containing 98, 33% sulphuric acid dissociates having been heated.
3. Sulphuric acid has a great affinity for water.
4. The acid must always be poured instantly into an excess of water.
5. To pour the water into acid is certain to lead to explosion.
6. The affinity for water makes sulphuric acid one of the best solutions for gases.
7. The acid reacts with water to form oxides.
8. Sulphurous acid is much stronger than sulphuric acid.
9. An aqueous solution of sulphuric acid has the properties of moderately strong, dibasic acid.
10. The dilute aqueous solution reacts with metals above nitrogen in the electrochemical series.
11. Concentrated solution reacts as an oxidizing agent with metals below and above hydrogen.
12. Sulphur dioxide is usually liberated in a process of reaction between sulphuric acid solution and metals.
13. Diluted agent is an active oxidizing agent when heated.
14. Sulphuric acid is often used in industry.

4. a) Fill in the words from the list to make phrases.

Drying; affinity; aqueous; pour; sulphuric; colourless; electrochemical; general; evolution; lead; laboratory; boiling.

1 ……. acid
2 ……...liquid
3 the ……. point
4 ……... for water
5 ……. of heat
6 to ……. gradually
7 to ……to explosion
8 ……...agent
9 ……. properties
10 ……... practice
11 ……. solution
12 ……..... series

b*) Make sentences using the completed phrases.*

5. Find in the text and translate into Ukrainian appropriate nouns to the following verbs.

To dissolve; to evolve; to explode; to contain; to liberate; to concentrate; to manufacture.

6. Match the antonyms.

coloured	a) above
dilute	b) concentrated
suddenly	c) excess
wet	d) active
below	e) gradually
weak	f) always
low	g) dry
lack	h) colourless
inert	i) strong

7. Retell the text according to the plan.

1. Properties of sulphuric acid;
2. it's affinity for water;
3. concentrated acid;
4. sulphuric and sulphorous acids;
5. aqueous solution of sulphuric acid;
6. interaction of metals with sulphuric acid;
7. industrial using of sulphuric acid.

8.Write a summary of the text.

9. Listen and watch the video 'Sulfuric Acid Mnufacturing Process'. Are the sentences true or false?

1. Sulphuric acid is used in manufacturing of limited range of products
2. It all begins with the roasting and smelting of nickel, zinc, copper and lead.
3. The first step of metallurgical refining is adding of sulphur content.
4. Smelter acid plants are comprised of five major stages.
5. During the first stage the gases are cleaned.
6. A tiny blower draws the cleaned gases to the conversion section.
7. The last stage is absorption, where the sulphuric acid is actually produced.

8. The first stage – gas cleaning- is unimportant stage.
9. The condensers reduce the amount of moist in the gases.
10. Each precipitator units contains 243 lead tubes.
11. The dry gases, free of mist and impurities, enter the second section through the massive blower.
12. One of the most critical steps in sulphuric acid production process is the oxidation of sulphur dioxide to sulphur trioxide.

Unit 2

Structure of Atoms

All kinds of matter are now known to consist of little particles called molecules; these molecules in turn are discovered to consist of still smaller particles called atoms. The name 'atom' comes from Greek word meaning 'indivisible' because atoms were supposed to be completely indivisible. Until the end of the 19^{th} century an atom was considered to be a 'simple, solid, hard, impenetrable particle'. Now it is believed to contain (except for hydrogen) three kinds of particles, these occupying only a portion of the whole space of the atom. The particles are electrons, protons, and neutrons. The existence of these particles in the atoms of the elements is fully established.

Electrons are negatively charged. They are thought to lie in different groups about the nucleus of the atom.

If atoms of matter contain negative electricity it is evident that they must contain also positive electricity in an equal amount: otherwise they would not be electrically neutral.

The positively charged atom of hydrogen is a proton. The hydrogen atom is stated to contain only one electron and one proton, and when the electron is removed from the atom, only the proton remains. Since the electron's weight is considered to be almost negligible, the mass of the proton is very nearly equal to the mass of the hydrogen atom. The mass of the proton is found to be 1836 times greater than that of the electron. The electrical charge of the proton is equal in magnitude to the charge of the electron, but it has the opposite sign (+ instead of -).

The neutron has no charge at all and its mass is assumed to be approximately equal to that of the proton.

The electrons are the outer portion of the atom. The electrons and the nucleus are very small as compared with the size of the atom, which, therefore, appears to be composed largely of empty space. The diameter of the whole

atom is estimated to be of the order of 10^{-8} cm, while that of the nucleus is believed to be very much smaller.

The atomic weight of an element tells us the number of protons and neutrons in the nucleus of an atom. Now if we could determine the positive charge of the nucleus, we should then know the number of electrons in the atom, as the total charge of electrons is equal to the charge of the nucleus.

1. Words and word-combinations to be remembered.

approximately - приблизно
as compared with - в порівнянні з
charge - заряд
to consider - вважати
empty - порожній
to estimate - визначати; приблизно підраховувати
fully - повністю
in turn - в свою чергу
kind - вид
largely - головним чином
to mean - означати
negative - негативний
to occupy - займати(місце)
otherwise - інакше; в іншому випадку
particle - частка
positive - позитивний
sign - заряд
size - розмір
indivisible - неподільний
impenetrable - непроникний
negligible - незначний
whole - цілий

2. Answer the following questions.

1) What do all kinds of matter consist of?
2) What is the meaning of the Greek word “atom”?
3) How many kinds of particles does an atom contain and what are their names?
4) What is a proton?
5) How many electrons and protons does the hydrogen atom contain?
6) What sign has the electrical charge of the proton?
7) What does the atomic weight of the element tell about?
8) What is the diameter of the whole atom?

3. Read the text and mark the following statements as true (T) or false (F).

1) All kinds of matter consist of little particles called atoms.
2) Atoms are small compounds of molecules.
3) The name “atom” comes from the Greek word meaning “divisible”.
4) Now atom is believed to contain three kinds of particles.
5) An atom consists of electrons, protons and neutrons.
6) Electrons are positively charged.
7) The positively charged atom of hydrogen is an electron.
8) The hydrogen atom contains one electron and one proton.
9) The mass of the proton is very nearly equal to the mass of the hydrogen atom.
10) The electrical charge of the proton is equal to the charge of the electron, and they have the same signs.
11) The diameter of the nucleus is much smaller than the diameter of the whole atom.
12) The total charge of electrons is equal to the charge of neutrons.

4. a) Fill in the words from the list to make phrases.

Fully; electrically; kinds; outer; equal; atomic; electrical; particles; opposite; whole; negative; approximately.

1 …… of matter
2 little ……...
3 ……. space
4 ……. established
5 ……. electricity
6 ……. amount
7 ……. neutral
8 ……. equal
9 ……... charge
10 ……. sign
11 …… portion
12 ……. weigh

b) Make sentences using the completed phrases.

5. Give antonyms to the following words.

Big; the beginning; soft; positive; complex; the same; unequal; to stay.

6. Give short positive and negative answers to the following questions.

1. Do all kinds of matter consist of molecules?
2. Are atoms invisible?
3. Must atoms contain positive electricity?

4. Has the electrical charge of the proton the opposite sign compared with that of the electron charge?
5. Has the neutron got any charge?

7. Retell the text according to the plan.

1) Molecules as little particles of matter;
2) atoms;
3) electrons;
4) protons;
5) neutrons;
6) atomic weight.

8. ***Write a summary of the text.***

9 Complete the sentences with words from the video 'Atomic Structure and Electrons'.

1. Atoms are the basic units of …elements.
2. They contain … particles in their nucleus and the electron cloud surrounds the nucleus.
3. Protons have positive electrical …, neutrons are uncharged and electrons have a negative charge.
4. The number of protons and electrons are …, so atoms are electrically neutral particles.
5. Each shell represents a different …. level and it can only hold a certain maximum number of electrons.
6. In chemical reactions between atoms only the electrons in the … shell participate in the resulting chemical bond.
7. In atoms with more than one energy level or shell, …. electrons are required in its outermost shell for stability.

Unit 3

Alkali Metals

The elements of the Periodic Group I A, lithium, sodium, potassium, rubidium and caesium are called the alkali metals. These are alike in having a single electron in the outermost shell; since this electron is far removed from the rest of the atom, it is easily lost. Therefore, from the chemical point of view, these

elements are the most active metals known. As we progress from lithium toward caesium, a striking increase in radius of the atom is to be observed.

Alkali metals have relatively low melting points and boiling points. They are soft enough to be easily cut with a knife, the softest being caesium. The latter is soft enough to be moulded between fingers. They are also very light, the lightest being lithium, sodium and potassium. They are so light as to float on water.

The untarnished surfaces of these metals may be seen to have a silvery lustre, but they rapidly tarnish and lose their lustre. The metals are usually stored in oil so as to exclude air. When stored in this way, they usually do not have a metallic appearance because of a surface coating.

The alkali metals are too active to be found free in nature. They are known to react with a number of non-metals, forming binary products, e. g. with chlorine to form chlorides, with bromine to form bromides and with sulphur to form sulphides.

The alkali metals are such active metals as to displace hydrogen from water, producing gaseous hydrogen and the hydroxide of the metal in solution. Potassium, rubidium, and caesium develop enough heat in this reaction to ignite the liberated hydrogen.

They also displace hydrogen from acids, but the reaction is too violent to be of importance.

Reacting with oxygen, lithium yields the simple oxide, sodium, on the other hand, yields the peroxide unless the temperature is kept relatively low. When heated in air sodium and potassium readily take fire, each metal forming a mixture of oxides. The ordinary temperature is sufficien*t* to ignite rubidium and caesium.

To prepare sodium hydroxide, a solution of sodium carbonate is added to staked lime, calcium hydroxide, suspended in water. When exposed to air sodium hydroxide absorbs moisture and carbon dioxide, so it is used to remove both moisture and carbon dioxide from the air.

1. Words and word-combinations to be remembered.

appearance - поява; зовнішній вигляд
alkali - луг; лужний
coating - покриття
to displace - витісняти; зміщувати
far - далекий; далеко
to float - плавати
lustre - блиск
to ignite - займатись; спалахувати
outermost - найдальший від середини (від центру)
slaked lime - гашене вапно
shell - орбіта; рівень
sufficient - достатній
tarnish - тьмяніти
toward - до; в напрямку до...

to mould - розминати
untarnished - свіжозрізаний

2. Answer the following questions.

1. What elements are called alkali metals?
2. In what respects are the alkali metals alike?
3. What are the properties of the alkali metals?
4. Why are the alkali metals stored in oil?
5. Why are the alkali metals not found free in nature?
6. In what way is sodium hydroxide usually obtained?

3. Read the text and mark the following statements as true (T) or false (F).

1. The elements of the Periodic Group II A are called alkali metals.
2. From the chemical point of view, lithium, sodium, potassium, rubidium and caesium are the most active metals known.
3. As we progress from lithium toward caesium, a decrease in radius of the atom is to be observed.
4. Alkali metals have relatively low melting and boiling points.
5. Alkali metals aren't soft enough to be cut with a knife.
6. Caesium is the softest one between alkali metals.
7. The lightest between alkali metals are lithium, sodium and potassium.
8. The untarnished surface of an alkali metal may be seen to have a golden lustre.
9. The alkali metals are too active to be found free in nature.
10. These metals are usually stored in oil as to exclude water.
11. When heater in air sodium and potassium readily take fire.
12. To prepare sodium hydroxide, a solution of sodium carbonate is added to slaked lime, suspended in sulphuric acid.

4. a) Fill in the words from the list to make phrases.

Alkali; outermost; view; metals; striking; point; untarnished; lustre; simple; carbonate; slaked; temperature.

1 melting ……...
2 ……. oxide
3 point of …….
4 sodium …….
5 ordinary …….
6 ……. metals
7 active …….
8 ……. surfaces
9 …… lime
10 silvery …….
11 …….. increase

b) Make sentences using the completed phrases.

5. Give antonyms to the following words.
Single; easily; active; increase; melting; the softest; tarnished; ordinary.

6. Translate into English using the table given below.
1) Відомо, що хлор – типовий неметал.
2) Сполуки лужних металів відрізняються за своєю промисловою важливістю.
3) Вода впливає на багато хімічних реакцій.
4) Лужні метали зберігаються в олії, щоб виключити вплив повітря.
5) Звичайної температури достатньо, щоб зайняти рубідій та цезій.
6) Гідроокис натрію використовується, щоб видалити з повітря як вологу, так і двоокис вуглецю.

Water	differ	to be a typical non-metal.
Chlorine	is used	to remove both moisture and carbon dioxide from the air.
Sodium hydroxide	is known	in their industrial importance.
The compounds of alkali metals	influences	in oil so as to exclude air.
The alkali metals	is sufficient	many chemical reactions.
The ordinary temperature	are stored	to ignite rubidium and caesium.

3. Retell the text according to the plan.
1) Lithium, sodium, potassium, rubidium and caesium are called the alkali metals;
2) properties of alkali metals;
3) reactions of alkali metals;
4) using of alkali metals.

4. Write a summary of the text.

5. Listen to the text 'Alkali Metals'. Are the sentences true or false?
1. Dmitri Mendeleev, a Russian, first proposed the periodic table of the elements.

2. Mendeleev arranged all the elements in order of decreasing atomic weight.
3. Mendeleev arranged all the elements in groups with related properties and the groups are shown vertically.
4. Within each group element shave different properties.
5. The proton has a positive charge and this is not balanced by the same number of electrons.
6. The hydrogen atom usually has neutrons.
7. Nitrogen has six electrons in its outermost shell.

Unit 4

Nitrogen

We have selected as the substance to be studied today the element nitrogen which is of particular interest and service to man.

The position of nitrogen in the Periodic Table would make us expect this element to be active chemically, like its neighbours oxygen and phosphorus, but this is not the case with nitrogen.

Nitrogen differs from all the other elements of this group in existing at ordinary temperatures as a colourless gas, consisting of diatomic molecules. The strength of the triple bond in the N-N molecule is remarkably great, as much as 274,000 calories being required to decompose a gram molecular weight. This large quantity of energy accounts for the inactivity of the element. Thus, the knowledge of the molecular structure of nitrogen enables the properties of the element to be clearly understood.

Nitrogen does not burn, nor does it support burning. At elevated temperature it combines to some extent with oxygen, forming NO, and more readily with some of the active metals.

On account of its inertness it is difficult to make nitrogen combine with other elements and its compounds are found to be unstable. Nitrogen can be made to combine with hydrogen to form ammonia, NH3, only by use of a suitable catalyst. Attempts to cause carbon and nitrogen to combine to form cyanogens (C2N2) have always met with failure.

The use of a high voltage electrical discharge to which the element is subjected enables active nitrogen to be produced.

Active nitrogen combines readily with many elements, including sulphur and phosphorus with which molecular nitrogen fails to react at all.

Aside from its use in the manufacture of ammonia, nitric acid and other compounds the nitrogen of the air is of great importance and value to man and to all forms of life. For example, it dilutes oxygen and therefore retards oxidation.

Life, certainly, would be quite different from what it is if atmosphere were composed of pure oxygen: it would probably be much shorter. The combustion of fuel in stoves and furnaces would be difficult to control, the corrosion of iron and steel would proceed so rapidly that their use would be impractical. The decay would also be greatly accelerated.

1. ***Answer the following questions.***

1. How does nitrogen differ from all the other elements of this group?
2. What is the strength of the triple bond in the N-N molecule?
3. What does the knowledge of the molecular structure of nitrogen enable?
4. Does nitrogen burn?
5. Why is it difficult to make nitrogen combine with other elements?
6. What elements does active nitrogen combine with?
7. Why would the life be different if atmosphere were composed of pure oxygen?

2. Read the text and mark the following statements as true (T) or false (F).

1. The element nitrogen is of particular interest and service to man.
2. The position of nitrogen in the Periodic Table would make us expect this element to be active chemically.
3. The neighbours of nitrogen oxygen and phosphorus are active chemically.
4. Nitrogen exists at ordinary temperatures as a coloured gas.
5. Nitrogen doesn't differ from all the other elements of this group.
6. The large quantity of energy accounts for the activity of the element.
7. The knowledge of the molecular structure of nitrogen enables to understand its properties.
8. Nitrogen doesn't burn, but supports burning.
9. Nitrogen combines with oxygen at elevated temperature.
10. Nitrogen doesn't combine with active metals at all.
11. Nitrogen combines with hydrogen only by use of a suitable catalyst.
12. Active nitrogen readily combines with many elements.

3. Words and word-combinations to be remembered.

to account for – пояснювати, мотивувати
aside from – окрім
certainly – звісно
failure – невдача; неможливість
to enable – давати можливість

elevated – підвищений
on account of – внаслідок
particular – даний; особливий; певний
to proceed – продовжувати; проходити
remarkably – значно; помітно
to select – обирати; відбирати
strength – сила; міцність
accelerated – прискорений
rapidly – швидко
combustion – горіння
stove – піч
furnace – піч
fuel – пальне

4. a) Fill in the words from the list to make phrases.

Chemically; temperature; colourless; diatomic; bond; molecular; clearly; elevated;
suitable; discharge; nitric; pure.

1 triple ……...
2 ……...……. catalyst
3 ……. acid
4 …… weight
5 ……... active
6 ……...molecules
7 ……temperature
8 ordinary ……
9 ……... oxygen
10 to understand …...
11 ……...gas
12 electrical …….

b) Make sentences using the completed phrases.

5. Give all forms of the next verbs.

To fall; to mean; to leave; to get; to understand; to burn; to learn; to find; to know.

6. Translate into English.

1. Лужні метали надто активні, щоб їх можна було вільно знайти в природі.
2. Білий фосфор настільки отруйний, що може спричинити хронічне отруєння.

3. Двоокис сірки використовується для відбілювання вовни, шовку та інших матеріалів (тканин).
4. Існує багато способів отримання сірки.
5. Звичайної температури достатньо, щоб запалити рубідій і цезій.
6. Це – спосіб отримання нової речовини без нагрівання.
7. Перекис барію було використано першою для цієї реакції.
8. Речовина, що має утворитись під час цієї реакції, має назву перекис водню.
9. Хлор добре відбілює при умові, що речовина, яку потрібно відбілити, буде волога.
10. Каталізатор використовують для того, щоб прискорити необхідний хімічний процес.
11. Збільшити швидкість цієї реакції означає отримати вибух, що розірве посудину.

7. Retell the text according to the plan.

1) Nitrogen in the Periodic Table;
2) properties of nitrogen;
3) reactions of nitrogen;
4) active and inactive nitrogen;
5) nitrogen in the manufacture.

8. Write a summary of the text.

Complete the sentences with words from the video.

1. Our atmosphere is made up of …per cent nitrogen.
2. We need nitrogen for the DNA and for the ….
3. We must absorb nitrogen in our ….
4. Nitrogen follows a cycle where it travels from the atmosphere to the soil, to … and back in its cycle.
5. Once in a soil it finds its way to ….
6. At the roots the nitrogen is combined with ….
7. Ammonium is ….
8. Additional bacteria convert these nitrites into ….

Unit 5

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.

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 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.

1. Words and word-combinations to be remembered.

at least – принаймні
appreciable – помітний, відчутний
as such – як такий
be likely – ймовірно, могти, мати тенденцію
to burn – горіти
by far – значно
certain – певний, деякий
consequent – послідовний
to fill – наповнювати
free – вільний
for instance – наприклад
in some respects – в деяких аспектах, в деяких відносинах
in steps – поетапно
never – ніколи
non-metal – металоїд, неметал
pronounced – великий, чітко виражений
to seem – здаватись
stable – стабільний
vigorous – енергійний
violently – енергійно, бурхливо
abundant – розповсюджений

2. Answer the following questions.

1. Why chlorine is 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?
7. What would happen to a mixture of methane and chlorine in the bright sunlight?

3. Read the text and mark the following statements as true (T) or (F).

1. Chlorine is never found in a free state because of its activity as a non-metal
2. In the combined state chlorine is one of the moderately abundant elements.
3. Sodium chlorine is the rarest from the chlorides.
4. Chlorine is readily soluble in water.
5. The density of chlorine is almost two and one-half times that of the air.
6. Chlorine is a typical metal.
7. Chlorine resembles oxygen in its reactions with metallic elements
8. Experiments prove chlorine to react with almost all of the non-metals.

9. Hydrogen and chlorine doesn't combine.
10. Hydrogen appears in the dark to combine with chlorine.
11. With certain compounds, chlorine is state to combine directly to form addition compounds.
12. Chlorine reacts with certain chlorides in much the same manner as oxygen reacts with certain oxides.

4. a) Fill in the words from the list to make phrases.
Pronounced; consequent; free; abundant; compounds; sodium; non-metal; elements; appreciable; bright; certain; oxidizing.

1 ……elements
2 metallic ……
3 ……. agent
4 ……...…activity
5 ……. chloride
6 ……. sunlight
7 ……tendency
8 ……. non-metal
9 ……compounds
10 ……. state
11 natural ……
12 ……...velocity

b) Make sentences using the completed phrases.

5. Give antonyms to the following words.
Natural; abundant; certain; free; vigorous; bright; slowly; ordinary; dry.

6. a) Translate the words in brackets into English.
1. (Завдяки) its inactivity this substance does not react with oxygen (якщо його не підігріти).
2. (Так як) white phosphorus is poisonous, it must be kept under water.
3. Ground water contains (багато) impurities, (отже) it is not pure.
4. (Згідно) this reaction much heat and light is liberated when the substances combine.
5. Silicon resembles carbon in having crystalline, (так як і) amorphous form.
6. (Що стосується) its chemical behavior oxygen is very reactive.
7. (Окрім того) we know chlorine to be a bleaching agent.
8. Absolutely dry chlorine, (однак), does not seem to attack metals.

b) Translate the sentences into Ukrainian.

7. Retell the text according to the plan.

1) The state of chlorine;
2) the most abundant natural compounds of chlorine;
3) the properties of chlorine;
4) the elements chlorine reacts with;
5) chlorine as an agent;
6) reaction of chlorine.

7. Write a summary of the text.

8. *Watch the video "Chlorine - Periodic Table of Videos" and answer the following questions.*

1. Describe the main characteristics of chlorine.
2. Where is the place of chlorine in the Periodic table?
3. How was chlorine used during the World War II? Was it a good weapon?
4. What is the impact of chlorine on human lungs?
5. Describe the experiment, shown in the video.
6. Where chlorine can be found in nature? How is it made?
7. What is a difference in characteristics of chlorine and chloride?

Unit 6

POLYSACCHARIDES AND SUGARS

Carbohydrates such as starch and sugar are a vital source of fuel for both plants and animals. They are found in much greater concentrations in plants because they are also used in building cell walls. Bacteria also have carbohydrate-based cell walls. Although animals are less dependent on the structural properties of carbohydrates, they perform a number of vital functions, either alone or combined with proteins and other molecules.

The name carbohydrate refers to the fact that carbohydrates are generally made up of hydrates of carbon. Hydrates are substances united chemically with water. Thus, a hydrate of carbon consists of hydrogen and oxygen (the two elements in water) and carbon. Most carbohydrates fit this definition, but some do not. Some also contain other elements, such as nitrogen or sulfur. The simplicity

of this definition disguises the fact that there is a tremendous variety of carbohydrates. There are also subtle differences in structure that affect their properties and distribution in nature.

The simplest of carbohydrates are the monosaccharides. The name saccharide comes from the word for sugar in Greek. More sacchnrides are single units made up of un-branched carbon chains between three and seven atoms long. The most common are the trioses (three carbons), pentoses (five), and hexoses (six), which are the best known. These single units can join together to form the other major carbohydrate groups. These are the oligosaccharides, which can contain as few as two monosaccharide units (for example, sucrose) and the polysaccharides, which may contain many thousands (for example, starch).

Structure

All simple carbohydrates contain a chain of carbon atoms, each joined to a hydroxyl group, which contains oxygen and hydrogen. One carbon atom is linked to an oxygen atom by a double covalent bond. This may be at the end of the molecule as in an aldehyde, in which case it is called an aldose. Alternatively, it may be similar to a ketone, with the double bond in the middle of the chain. It is then known as a hetose. Glucose and fructose are both hexose sugars, but the former is an aldose and the latter a ketose.

The number of atoms alone does not determine the structure of the molecule. Apart from one of the simple triose sugars, all monosaccharides contain at least one asymmetrical carbon atom. This is a carbon atom uniquely attached to the molecule. There is no corresponding carbon atom on the opposite side to give a balanced arrangement. Because of its special shape, a carbon attached to four different groups can arrange the groups into two separate formations that are mirror images of each other. This phenomenon is known as stereoisomerism. Sugars can have several asymmetrical carbon atoms.

For simplicity, the structure of glucose is often shown as a straight chain. In reality, the ends of the chain come together to form a ring. This accounts for two more important types of isomerism, isomerism is a phenomenon in which the same number and types of atoms join together in different ways, producing more than one distinct compound. Thus, two compounds can have the same chemical makeup, but different physical qualities. For example, a glucose molecule can form either a six- or a five-membered ring. The form with five carbons and one oxygen atom in the ring is the commonest because it is more stable.

Also, the new hydroxyl group in the five-membered ring can be either above (termed beta) or below (alpha) the plane of the ring. This difference between the beta and alpha forms is important in determining the properties of some polysaccharides.

Common carbohydrates

There are 16 compounds in the glucose family. Apart from glucose itself, only two of these (mannose and galactose) are common in nature. Glucose is the sugar that occurs naturally in the blood. It is used by the tissues in releasing energy. In plants, glucose is made by photosynthesis. This is a process that makes the glucose from water and carbon dioxide in the presence of light. Animals are not able to make glucose directly. They obtain their glucose by digesting plants or other animals.

Fructose (fruit sugar) is common in plants. It is combined with glucose to make the disaccharide sucrose.

A disaccharide consists of two monosaccharide units. Sucrose is also found in honey. Sucrose, or cane sugar, is a temporary energy store for many plants. It must be broken down to its individual monosaccharide residues before it can be absorbed by animals. Maltose and lactose are two other important disaccharides. Maltose is a simple combination of two glucose molecules. It is found in germinating seeds, such as barley, and in the middle stages of the breakdown of more complex sugars. Lactose is the sugar found in milk. It is formed from one molecule each of glucose and galactose.

As with the monosaccharides, the disaccharides are all sweet-tasting soluble solids. Being soluble means that they can be dissolved in a liquid. On the other hand, starch does not taste sweet. It is the common storage product of green plants such as cereals and potatoes. Starch is a combination of two polysaccharides, the highly branched amylopectin and the straight-chained amylose molecule. Each polysaccharide consists entirely of glucose. The mixture of these polysaccharides forms microscopic granules in the storage tissues of green plants. These granules stain blue in contact with iodine.

Glycogen, a glucose storage molecule, is found in animals. In some ways, it is so similar to starch that it is often called "animal starch." These large molecules are useful in storage because their molecular concentration is low. In other words, they do not take up much space. Glycogen is found mainly in the muscles and liver of vertebrates—animals having backbones. Because the glycogen molecule has many branches, the stored glucose can be quickly and easily utilized whenever the tissues need these for energy.

VOCABULARY

starch – крохмаль
fit – підходити
subtle – невеликий, незначний
aldose – альдоза
corresponding – відповідний
arrangement – розташування

makeup – структура
germinating seeds – проростлі насіння

1. Answer the following questions to check your understanding of the text.

a. Where are the carbohydrates found in?
b. How are hydrates united chemically?
c. Where does the name saccharide come from?
d. What is the structure of all simple carbohydrates?
e. What is the stereoisomerism?
f. What is the structure of glucose family?
g. What is the maltose?
h. What is the lactose?

2. Translate the following words.

Polysaccharides, sugar, cell walls, bacteria, carbohydrates, hydrogen, oxygen, carbon.

3.Find English equivalents for the following Ukrainian word-combinations.

Містити, азот, сірка, прихованний, структура, властивості, ковалентний зв'язок, альдегід.

4. Translate the following sentences.

These single units can join together to form the other major carbohydrate groups. Cellulose is the major constituent of the cell walls of higher plants. It is made up of glucose units in long chains. The fibrous quality of cellulose makes it useful in the textile industry as cotton. Unfortunately, its structure makes it indigestible to most animals. Those that can digest it (such as cows and termites) possess special bacteria in their intestines. These bacteria contain the enzymes needed to break up the long chains of glucose units. Chitin is a similar insoluble compound found in the shells of insects and crustaceans. The basic building unit here is a nitrogen-containing derivative of glucose. Some carbohydrates occur in combination with different types of molecules. For example, they combine with proteins to form glycoproteins or with fats to form glycolipids.

5. Insert the missing words. Be sure that you understand the text.

As with the monosaccharides, the disaccharides are all sweet-tasting (…….) solids. Being soluble means that they can be (…….) in a liquid. On the other (…….), starch does not taste sweet. It is the common storage product of green (…….) such as cereals and potatoes. Starch is a (……) of two polysaccharides, the highly branched amylopectin and the straight-chained amylose molecule. Each polysaccharide (…….) entirely of glucose. The mixture of these polysaccharides (……) microscopic granules in the storage tissues of green plants. These granules stain blue in (……) with iodine.

Glycogen, a glucose storage molecule, is (…….) in animals. In some ways, it is so similar to starch that it is often called "animal starch." These large molecules are useful in storage because their molecular concentration is (….). In other words, they do not take up much (…….). Glycogen is found mainly in the (…….) and liver of vertebrates—animals having backbones. Because the glycogen molecule has many branches, the stored (…….) can be quickly and easily utilized whenever the tissues need these for energy.

6. Complete the following sentences. Use the vocabulary from the text.

a) Maltose and lactose are…
b) Glucose is…
c) Thus, two compounds …
d) Sugars can…
e) Glycogen is found mainly in…
f) Most carbohydrates…
g) Bacteria also have…

7. Write down the synonyms for the following words.

Solid, dissolve, combine, entirely, mixture, forms.

8. Give opposites of the following words.

Sweet-tasting, soluble, liquid, storage, highly, consist.

9. Make a plan of the text and give a summary to cover the topic ‘Polysaccharides and sugars’.

Complete the sentences with words from the video.

1. A polysaccharide is formed when many … molecules join together.
2. …. is the reaction in which molecule is released as by-product.
3. … is one of the most important sources of carbohydrates in our food.
4. The … units are liked by “bridges” or chemical bonds.
5. … is a type of carbohydrates that makes up cell walls of plants.
6. … is sometimes referred to as “animal starch”.
7. Glycogen and … are suitable as storage materials.

Unit 7

LIPIDS

Lipids are a large and very diverse group of compounds that occur naturally—for example, as fats and oils. The only difference between a fat and an

oil is the melting point. An oil is simply fat that is liquid at room temperature. Lipids contain long chains, or ring systems, of carbon atoms, with or without a group of atoms at one end. This chain makes them relatively insoluble (unable to dissolve) in water. Lipids, however, are soluble in organic solvents such as ether, trichloromethane (chloroform), and benzene. This solubility accounts for many of their biological properties.

Triglycerides

The simplest and most common lipids are fats and oils, called triglycerides. They are esters made up of glycerol (a type of alcohol) and residues of three fatly acids. Esters are a class of compounds produced by reaction between acids and alcohols with the elimination of water. The fatty acids are usually long-chain acids that are found in most but not all of those compounds classified as lipids. Many natural fats and oils, such as butler and olive oil, are mixtures of several different triglycerides. The presence of large numbers of unsaturated fatty acids lowers the melting point of the triglyceride. Unsaturated molecules have "space" for atoms or groups of atoms to attach to them. They are not "full." Thus, only a low melting point is needed, because the molecules are "ready" to take on other atoms or groups of atoms. The presence of a high proportion of short-chain acids also lowers the molting point. Margarine is made solid by artificially saturating vegetable oils, which are high in unsaturated chains.

Phospholipids

Along with carbohydrates, lipids are the main sources of energy in the diet. But they also have a number of other important functions. The most important of these is in forming cell membranes (the walls of cells). All cells, plant and animal, take advantage of the hydrophobic (water-avoiding) properties of the fatty-acid chain. Substituting one of the fatty acids in a triglyceride with a phosphoric acid molecule gives the complex a hydrophilic (water-attracting) end that mixes easily with water. If this phosphate residue is chemically combined with an alcohol, the product is a phospholipid. If spread onto water, a phospholipid forms a single-molecule layer on the surface. The top of each molecule (composed of fatty acids) does not absorb water. The bottom of each molecule (composed of the phosphoric acid) does absorb water.

In principle, a cell membrane could consist of two such monolayers. The hydrophobic fatty-acid chains, which do not absorb water, would be oriented toward each other. The molecules of phosphoric acid, which mix easily with water, would face the water on either side of this "sandwich." Such a cell membrane would form a "skin" less than one millionth of an inch thick. In practice, however, cell membranes are not so simple, having a number of different substances incorporated into them.

For example, membranes contain minute pores lined with protein. These pores allow substances to pass through selectively. Other proteins on the inside or outside of the dual skin layer perform other specialized functions.

Sphingolipids

Other types of lipids are also important in forming membranes. The second largest group are called sphingolipids. These are similar to phospholipids in that they both contain a phosphate. Sphingolipids are made up of a fatty acid running parallel to and linked to sphingosine, a long-chain molecule amino alcohol. There are three main types of sphingolipids. The sphingomyelitis are the simplest and most common. They occur in the myelin layers that surround nerve cells.

The second type, cerebrosides, have no phosphorus. Instead, they contain a carbohydrate molecule, usually a sugar. Galactose is a sugar residue in cerebrosides found in the brain. Glucose is found in the cerebrosides of non-nerve tissue.

The third group of sphingolipids are called gangliosides. They possess a very large end containing several carbohydrate units and are found in highest concentration in the gray matter of the brain.

Lipids in the diet

Most lipids can be made in the body from carbohydrates or proteins. Two lipids— linoleic acid and linolenic acid—cannot be synthesized in the body. But they necessary for the maintenance of health and are, therefore, called essential fatty acids. A deficiency of them can result in kidney failure and retarded growth. Such conditions are rare in the developed countries of the West because these acids occur in seed oils and fish. These foodstuffs are generally included in a balanced diet. Triglycerides make up most (around 96 per cent) of the lipids in food.

The average Western diet is high in fats. This factor is now known to be one of the causes of the high incidence of heart disease, strokes, and other cardiovascular disorders in developed countries. Cardiovascular disorders affect the heart and the blood vessels. Animal fats, such as those in dairy products and red meat, are high in saturated fats. They may be partly responsible for these disorders because they cause a build-up of abnormal fatty patches on the inner lining of the walls of arteries. This condition—called atherosclerosis-can eventually lead to the blocking of vital arteries. If the blockage happens to occur in the coronary artery—the artery that gives the heart its blood supply—a bean attack may follow.

VOCABULARY

insoluble – нерозчинний
fatly acids – жирові кислоти
phosphate – фосфад, сіль фосфатної кислоти
absorb – вбирання, поглинання

inch – дюйм
membrane – мембрана
nerve cells – нервові клітини
carbohydrate molecule – вуглеводна молекула
maintenance – підтримка
heart disease – серцеве захворювання

1. Answer the following questions to check your understanding of the text.

a) What are the lipids?
b) What is the difference between fat and oil?
c)What are the triglycerides?
d)What are the phospholipids?
e) What is the second largest group?
f) What can be made in the body from carbohydrates or proteins?

2. Translate the following words.

Lipids, diverse, fats, oils, ring systems, benzene.

3. Find English equivalents for the following Ukrainian word-combinations.

Складний ефір, гліцерол, за вийнятком, ненасичений, танути, штучний.

4. Translate the following sentences.

Several other factors, such as smoking and high blood pressure, are also involved. And diets rich in animal fats are known to increase the levels of lipoproteins in the blood. Lipoproteins are complexes of lipid and protein that allow lipids to be carried from the liver to the tissues. One type of lipoprotein, called HDLP, probably protects against atherosclerosis. On the other hand, increased levels of another type, LDLP, along with the fatlike compound cholesterol, encourage atherosclerosis.

5. Insert the missing words. Be sure that you understand the text.

The average Western diet is (…….) in fats. This factor is now known to be one of the (…….) of the high incidence of heart disease, strokes, and other cardiovascular disorders in developed countries. Cardiovascular disorders affect the (……) and the blood vessels. Animal fats, such as those in (……. …….) and red meat, are high in saturated fats. They may be partly responsible for these (……) because they cause a build-up of abnormal fatty patches on the inner lining of the walls of arteries. This condition—called (…….)-can eventually lead to the blocking of vital arteries. If the blockage (…….) to occur in the coronary artery – the artery that gives the heart its blood supply – a bean attack may follow.

6. Continue the following sentences. Use the vocabulary from the text.

a) A deficiency of them can…
b) The second type, cerebrosides, …
c) These are similar to phospholipids…
d) In principle, a cell membrane…
e) If spread onto water, …
f) The presence of large numbers …
g) The only difference between…

7. Write down the synonyms for the following words.

Body, made, maintenance, essential, fail, generally, causes.

8. Give opposites of the following words.

Necessary, deficiency, retarded, rare, balanced, block, protect.

9.Make a plan of the text and give a summary to cover the topic "Lipids"

10.Listen and watch the video 'Lipids'. Are the sentences true or false?

1. The primary function of lipids is long-term energy storage.
2. Lipids are used for protection, absorption and lubrication.
3. There are three basic groups of lipids.
4. Lipids are soluble in water.
5. Lipids are hydrophobic.
6. Unsaturated acids have three to ten double bonds.
7. A fatty acid is a large part of triglyceride.
8. Steroids are composed of five fused rings of carbon.
9. Waxes are non-polar and repel water.
10. Lipids are a key component of hormones and cell membranes.

Unit 8

NUCLEIC ACIDS

Nucleic acids are the means by which information about the structure and function of a living organism is stored and passed on to the next generation. Nucleic acids consist of only two types of molecules, deoxyribonucleic acid

(DNA) and ribonucleic acid (RNA). They are found in the cells of all living organisms, from viruses to humans.

Structures of nucleic acids

Both RNA and DNA are made up of recurring units called nucleotides. These consist of complexes of three different molecules: a five-carbon monosaccharide (sugar), an organic base, and phosphoric acid. In RNA, the sugar is ribose. In DNA, it is deoxyribose, a ribose derivative.

The organic bases of DNA include two compounds and two molecules. The two pyrimidine compounds are cytosine (C) and thymine (T). The two purine molecules are adenine (A) and guanine (G). In RNA, uracil (U) is substituted for thymine. The sugar molecule is attached to both the phosphoric acid and the base. The phosphoric acid is linked to the sugar of the next nucleotide. Hence, any sugar molecule in the middle of the chain is linked to one base and two phosphoric acid residues.

Although the basic parts of nucleic acids had been known for many years, it was not until 1953 that Francis Crick and James Watson of Cambridge University worked out the three-dimensional structure of the DNA molecule. They suggested that the bases of two nucleotide chains are connected together by hydrogen bonds. The sugar and the phosphate run alternately along each side. This structure is similar to that of a ladder. The bases connected by the hydrogen bonds form the rungs. The sugars and phosphates form the sides of the ladder. The ladder is twisted into a regular helical formation, the famous DNA double helix. A helix has a spiral, coiled form, like a spring. The purine and pyrimidine bases are always found in complementary pairs. Adenine links with thymine. Guanine is in combination with cytosine.

The DNA double helix stores all the information about the structural proteins and enzymes that make up the organism. A few viruses contain only RNA and do not possess DNA. But in all other species, the purpose of the RNA is to transcribe the information stored in the DNA. The information is then transferred to sites in the cell, called ribosomes, where it is translated into the making of protein.

The genetic code

The sequence of organic bases in a DNA molecule forms what amounts to a four-letter code. This code must provide the words in an enormous encyclopedia of possible protein types. There are at least 20 words or amino acids in proteins. A single base obviously does not give sufficient information to specify what is needed to make the protein. Three bases together give a choice of 64 (4X4X4) combinations. Of these combinations of the four bases – A, C, G, and T – a total of 61 code for specific amino acids. Several different combinations therefore code for the same amino acid. The remaining three compounds perform the same function as the period at the end of a sentence. They show that the last amino acid in the protein has been reached. This

theory that three bases code for a particular amino acid is supported by experimental evidence. The three-base unit is referred to as a codon.

DNA is found mainly in the nucleus of plant and animal cells. Proteins are manufactured in the cell, but outside the nucleus. They are manufactured by ribosomes within the cytoplasm, fluid that fills the inside of a cell. A complex chain of events links the DNA with the actual manufacture of protein.

Protein synthesis

The double helix of DNA is the largest molecule in the cell. RNA exists as much smaller molecules and in several different types. To relay information to the ribosome (which manufactures the protein), the two strands of the DNA double helix must first split apart, like a zipper, along the appropriate part of the molecule. A molecule of messenger RNA (m-RNA) is then formed from free nucleotides. The nucleotides pair with the bases of the section of DNA coded for the required protein. The RNA bases pair only with the complementary bases of the DNA. Thus, the information is coded "in negative." The sequence of the RNA must be transcribed back into its original form. This is done after the m-RNA has moved out of the cell and taken up a position on the ribosome. Another RNA molecule called transfer RNA (t-RNA) picks up a free amino acid and takes it to the ribosome. The enzymes that control this attachment are highly specific. Each molecule of, t-RNA carries only one type of amino acid.

The t-RNA molecule is smaller than m-RNA It consists of a single nucleotide chain twisted back on itself into a cloverleaf shape. At one end is a sequence of three bases that attach to the appropriate complementary codon (three-base unit) on the m-RNA. The amino acid at the other end is enzymatically joined to the poly-peptide chain as the m-RNA slides along the ribosome. Several protein molecules may be formed simultaneously from the same m-RNA molecule.

The same genetic material is found in ail the cells of an organism. But not all the cells produce the same proteins. There are also differences in the rates of production between cells. The mechanism by which the function of a gene (the section of DNA that codes for a particular protein) is controlled is not completely understood. Production of a protein can be stopped or slowed down in three ways. The DNA can stop making m-RNA. Attachment on the ribosome can be prevented. Or the rate at which m-RNA is destroyed can be increased.

VOCABULARY

nucleic acids – нуклеїнові кислоти
store – зберігати
hence – звідси
sequence – послідовність
sufficient information – достатня інформація
simultaneously – одночасно

1. Answer the following questions to check your understanding of the text.

a) What do Nucleic acids consist of?

b) What do the organic bases of DNA include?

c)What is the genetic code?

d)What is the protein synthesis?

2. Translate the following words.

Nucleic acids, generation, deoxyribonucleic acid, ribonucleic acid, viruses, recurring, nucleotides, a five-carbon monosaccharide, an organic base, phosphoric acid.

3. Find English equivalents for the following Ukrainian word-combinations.

Заміна, приєднувати, кислота, поєднувати, осад, трьох-мірна структура, згинання, петля.

4. Translate the following sentences

DNA is a huge, extremely complicated molecule. It is inevitable that mistakes in its duplication occasionally occur. These are called mutations. They happen when the wrong base is coded or when sections of DNA are removed or put in the wrong place. Ionizing radiation (like atomic fallout) and some chemicals increase the rate at which these mistakes occur. They probably inhibit the natural repair mechanisms. Some mutations produce inheritable diseases. This usually happens where the change causes the production of the wrong amino acid. This renders an enzyme ineffective by altering its shape.

Mutations are now also known to cause cancer, which is an abnormal growth of particular cells. But not all mutations are damaging. Some cause beneficial variation in a species, which is an important mechanism in evolution.

5. Insert the missing words. Be sure that you understand the text.

The t-RNA molecule is smaller than (….). It consists of a single nucleotide chain twisted back on itself into (….) shape. At one end is a sequence of three bases that (….) to the appropriate complementary codon (three-base unit) on the m-RNA. The amino acid at the other end is (…….) joined to the poly-peptide chain as the m-RNA slides along the ribosome. Several protein molecules may be formed (…….) from the same m-RNA molecule.

The same (……) is found in ail the cells of an organism. But not all (…….) produce the same proteins. There are also (…….) in the rates of production between cells. The mechanism by which (…….) of a gene (the section of DNA that codes for a particular protein) is controlled is not completely understood. Production of (….) can be stopped or slowed down in three ways. The DNA can stop (…….) m-RNA. Attachment on (……) can be prevented. Or the rate at which m-RNA is (…….) can be increased.

6.Complete the following sentences. Use the vocabulary from the text.

a) They are found in the cells…
b) The sugar molecule is …
c) The bases connected by…
d) A few viruses contain…
e) Three bases together give…
f) Proteins are…
g) The nucleotides pair …

7.Write down the synonyms for the following words.

Coil, form, spring, possess, purpose, species, sequence, must.

8. Give opposites of the following words.

Regular, helical, formation, famous, organic, amount, enormous, possible.

9.Make a plan of the text and give a summary to cover the topic "Nucleic acids"

11.Watch the video and answer the following questions:

12.Where can we find nucleic acids?

1. What are they responsible for?
2. How are monomers called?
3. Name the components of nucleotides.
4. How are nucleotides linked together?
5. What is DNA composed of?
6. What is the difference between RNA and DNA?
7. What is ATP?
8. What is ATP composed of?

Unit 9

ENZYMES

Enzymes are highly specialized proteins that control the chemical reactions in all living cells. They operate as organic catalysts, lowering the amount of energy needed to power a reaction, thus speeding it up. Indeed, many biochemical reactions need large amounts of energy. In the absence of a catalyzing enzyme,

most metabolic processes would proceed far too slowly to maintain life. Most enzymes are found within cells. Some are released to catalyze reactions outside cells, such as the digestion of food in the stomach and intestines.

Properties of enzymes

The essential feature of both organic and inorganic catalysts is that they participate in a reaction by promoting a chemical change, but remain unaltered themselves. There is an enormous variety of enzymes because each one is usually involved in only a single reaction. Although enzymes are highly specific, it is interesting that the same enzymes or groups of enzymes are often found in a wide variety of organisms. This fact accounts for the similarity in basic metabolic functions in plants, animals, and bacteria. Metabolic functions are the processes by which food is turned into energy and living tissue.

Enzymes need be present only in minute quantities to affect the rate of a reaction. They are extremely fast acting. Catalase is one of the most rapid enzymes; it is found in the liver. It has been estimated that catalase can break up hydrogen peroxide molecules into water and oxygen at the rate of 40,000 molecules per second.

All chemical reactions are reversible. The direction of the reaction depends on the physical and chemical conditions at a particular time. An enzyme can break down a substrate A into its products B and C. A substrate is the molecule that the enzyme acts upon. The same enzyme is then equally capable of catalyzing the reverse reaction. It does not alter the concentrations in which the three constituents—A, B, and C—are found when the reaction reaches equilibrium, a state of balance. The enzyme merely reduces the time needed to reach this state.

Because they are made of protein, enzymes share the properties of proteins. Enzymes are sensitive to temperature and acidity. Raising the temperature generally improves the efficiency with which an enzyme operates. But above a certain temperature, the protein becomes damaged: the hydrogen bonds in the molecule start to break and the protein becomes denatured, losing its shape and its effectiveness. Few enzymes can work about 108° F. (42° C). Some, such as those in the bacteria that live in hot-water springs, can operate at higher temperatures. Similarly, enzymes have an optimum acidity level at which they work best. This is often around neutral— neither acidic nor alkaline. Some, such as pepsin (which breaks up protein in the stomach), operate only in acid conditions. Others function best in an alkaline environment.

Controlling enzyme functions

Enzymes are usually named after the reaction they regulate. Hence, an enzyme that specifically catalyzes the removal of hydrogen from a substrate molecule is called a dehydrogenase. The suffix -ase signifies that the molecule is an enzyme.

There are several theories to explain why enzymes are specific and how they operate. They all center on the enzymes' three-dimensional structure. The simplest theory is the "lock-and-key" hypothesis. It postulates that a substrate molecule (the "key") attaches itself to an active site (the "lock") of an enzyme molecule, forming a temporary complex. The active site has a particular shape. So only a substrate with the complementary shape can attach itself to this site. In the same way, a lock only accepts a key with the right shape. Hence, molecules with different shapes cannot attach to the active site. Also, if [he active site is distorted by excessive heat, the molecule itself will no longer fit.

However, some other compounds may be close enough in shape to the substrate to fit into the active site of the enzyme. These alien substrates are not changed through contact with the enzyme. Rather, they compete with the true substrate for active sites. This inhibits the enzyme's activity.

There are two types of inhibition. In competitive inhibition, an alien molecule forms only a temporary bond with an enzyme. In noncompetitive inhibition, an alien inhibitor molecule either permanently blocks an enzyme's active site or affects it by temporarily binding to a site elsewhere on the enzyme. Many inhibitors, particularly of the noncompetitive type, act as poisons. Cyanide which binds with an enzyme necessary for cellular respiration is a good example. Cellular respiration is the process by which cells get oxygen.

More complicated theories of enzyme action hold that an enzyme exists in two separate shapes. A nonactive enzyme would then have one shape. When the same enzymes are active it would have another shape. Some enzymes do not work without the presence of what are called cofactors. Some cofactors participate in the enzyme reaction. Others probably lock into the enzyme away from the active site. They hold the enzyme in the correct position to receive the substrate.

VOCABULARY

within – у, в
digestion of food – перетравлення їжі
stomach – шлунок
intestines – кишки, кишечник
essential feature – головна риса
participate – брати участь
extremely – надзвичайно
temporary bond – тимчасовий зв'язок
complicated – складних

1. Translate the following words.

Enzymes, highly specialized, chemical reactions, living cells, operate, organic catalysts, lowering.

2. Find English equivalents for the following Ukrainian word-combinations.
Властивості ферментів(ензимів), органічні каталізи, неорганічні каталізи, залишати, незмінний, різноманітний, обмін речовин.

3. Answer the following questions to check your understanding of the text.
a) What are the enzymes?
b) What do they operate?
c) What are the properties of enzymes?
d) What is the one of the most rapid enzymes?
e) Can an enzyme break down a substrate A into its products B and C?
f) What are the enzymes sensitive?
h) How are the enzymes usually named?
i) What are the theories to explain why enzymes are specific?

4. Translate the following sentences.
Must enzymes work as part of a chain of reactions during metabolism. The product of one enzyme-induced reaction then becomes the substrate for another. To prevent the wasteful production of unnecessary amounts of a particular substance, the whole reaction sequence is controlled by the slowest step.

Enzymes may consist entirely of protein. Or they may consist of protein linked to a group that helps to maintain the shape of the molecule. The group may also participate in the reaction. Sometimes, such a group fulfills both these functions. Trace metal minerals (such as iron and cobalt) are often necessary in the diet. They are used by these groups. Water-soluble vitamins are often important because they are cofactors in an enzyme system.

5. Insert the missing words. Be sure that you understand the text.
There are two types of (…….). In competitive inhibition, an alien molecule forms only a temporary bond with (……). In noncompetitive inhibition, an alien inhibitor molecule either (…….) blocks an enzyme's active site or affects it by temporarily binding to a site elsewhere on the enzyme. Many inhibitors, particularly of the (…….) type, act as poisons. Cyanide, which binds with an enzyme necessary for (…….) respiration, is a good example. Cellular respiration is the process by which cells get (…….).

More complicated theories of (…….) action hold that an enzyme exists in two separate shapes. A (……) enzyme would then have one shape. When the same enzymes are active it would have another shape. Some enzymes do not work without (……) of what are called cofactors. Some (…….) participate in the enzyme reaction. Others (……) lock into the enzyme away from the active site. They hold the enzyme in the correct (…….) to receive the substrate.

6.Complete the following sentences. Use the vocabulary from the text.

a) Enzymes are highly specialized …
b) There is an enormous variety of…
c) Catalase is…
d) All chemical reactions…
e) Few enzymes …
f) The simplest theory…
g) This inhibits…

7. Write down the synonyms for the following words.

Feature, turned, present, extremely, estimated, reversible.

8. Give opposites of the following words.

Similarity, affect, break up, depends, particular, equally.

9. Make a plan of the text and give a summary to cover the topic "Enzymes"

10. Watch the video and answer the questions.

1. Who was the first to discover the vital force of enzymes?
2. Give the definition of enzymes.
3. How do enzymes speed up chemical reactions?
4. How is the specific place in enzymes called?
5. What do many enzymes consist of?
6. Explain what the "induced fit" means.
7. Factors that include the active site include…
8. What is the influence of inhibitors on enzymes?
9. Name the two types of inhibitors.

Unit 10

AMINO ACIDS AND PROTEINS

Proteins are the most common large molecules in living things. They make up about 50 per cent of all organic matter. Proteins are important structural parts

of the tissues of cells and of (he substances between the cells. They also have an essential role in the control of chemical reactions in the body. Enzymes (discussed in the following article) and many hormones (discussed later in this section) are proteins.

Amino acids

Just as carbohydrates and lipids are made of simpler molecules, all proteins are constructed from amino acids. There are around 20 common amino acids. These form a kind of alphabet from which all the words and sentences in an almost infinitely large book can be made. There is another group of amino acids, many of which are simple derivatives of the common types. These are occasionally found as part of a specific protein in a particular species. With the exception of two of them all the amino acids contain just four elements: carbon, hydrogen, oxygen, and nitrogen. The two exceptions are methionine and cysteine, each of which contains a single sulfur atom.

It is the grouping of the four elements in amino acids that makes them so important. Small groupings of amino acids are known as peptides. If the amino acids join together with the loss of a molecule of water, they form dipeptides. The process can be repeated several times until a polypeptide is formed. Longer chains, with perhaps more than 100 units, are referred to as proteins.

In every protein amino acid, a single carbon atom carries four important bonds. Attached to it are two unlike compounds, a hydrogen atom, and a side chain, the nature of which defines the particular amino acid. Thus, the carbon atom at the center of an amino acid has four different groups attached to it. It is therefore asymmetric. Glycine is the only exception. Asymmetric means that one half of the carbon molecule is not a mirror image of the other half. The ammo acid is not balanced (symmetrical).

Structures of proteins

Proteins are very large molecules with molecular weights often in the tens of thousands. By contrast, an atom of hydrogen, the smallest element, has an atomic weight of just under 2. Carbon is about 12. Proteins fall into two main categories. The first category includes the highly folded and roughly spherical globular proteins, such as globulin. These proteins tend to be soluble in water. This means that they can dissolve in water. The second category consists of the long fibrous proteins such as the keratin of human hair. These proteins are insoluble. Their highly complicated shapes are determined at four separate levels.

The primary structure is determined by the sequence of the amino acids, like the beads in a necklace. The sequences in proteins having the same functions tend to be similar even in very different species. But with 20 different amino acids to choose from, the possibilities for variation are enormous. Some proteins are unique to a particular species.

The secondary structure of a protein is the result of the attraction between the peptide bonds in neighboring sections of the polypep-tide chain. Peptides are small groupings of amino acids. When a number of peptides link (bond) together, they are known as a polypeptide chain. Because peptide bonds can occur at regular intervals

along the chain, a coiled structure like a telephone cord is formed. This is called the alpha helix. A different pleated form called the beta structure occurs in some proteins.

These regular structures can, however, be distorted by the influence of the side chains of some amino acids. These side chains can form hydrogen bonds with other parts of the molecule or with other side chains. The folding of the chains into a three-dimensional shape as a result of these distortions in the helix is called the tertiary structure.

Some proteins also possess a quaternary structure. This results from the shape taken up when two or more smaller polypeptide molecules join together.

Specialized proteins

Hemoglobin is an example of a protein with a quaternary structure. It is the red substance that carries oxygen in the blood. It consists of four polypeptide chains, each of which is grouped around a heme group. Each of the four hemes contains an iron atom that bonds temporarily with oxygen. Like the related coin-pound myoglobin in muscle, hemoglobin is classified as a conjugated protein. Conjugated proteins also contain nonprotein groups. They are important in a number of biological functions. Chlorophyll, the green pigment found in plants, is closely related to heme. But it contains magnesium instead of iron.

VOCABULARY

oxygen- кисень
blood – кров
magnesium – магній
possess - володіти
folding – складаний
three-dimensional – тривимірний
neighboring – суміжний
coiled – складений витками
fibrous – волокнистий

1. Translate the following words.

Amino acids, methionine, cysteine, a single sulfur atom, peptides, dipeptides, polypeptide, a single carbon atom.

2. Find English equivalents for the following Ukrainian word-combinations.

Загальних, зрідка, повторюватись декілька разів, важливі зв’язки, асиметрія, сферичний, глоулін.

3. Answer the following questions to check your understanding of the text.

a) What are amino acids?
b) What are the structures of proteins?
c) What are the main categories have proteins?
d) Are these proteins insoluble?

e) What are the peptides?
f) What is the alpha helix?
g) What is the hemoglobin?

4. Translate the following sentences.

Antibodies are another type of specialized protein. They form part of the body's defenses against disease. Antibodies bind to a foreign protein or carbohydrate in the blood. This may cause the foreign bodies to clump together (agglutination). Otherwise, the antibodies "tag" the foreign bodies, triggering off a set of processes that results in their destruction. Antibodies combine with a particular point on the surface of the foreign body (called the antigen).

Proteins in food can be used by the body as a source of energy. The body's own protein is used up only during starvation. Amino acids cannot be made from inorganic materials by humans. They have to be obtained from food, although some so-called nonessential amino acids can be synthesized from other amino acids. Others, called essential amino acids, cannot be synthesized. A deficiency in the diet will retard growth.

5. Insert the missing words. Be sure that you understand the text.

Hemoglobin is an example of (…….) with a quaternary structure. It is the red (……) that carries oxygen in the blood. It consists of four (…….) chains, each of which is grouped around a heme group. Each of the four (……) contains an iron atom that bonds temporarily with oxygen. Like the related coin-pound (……) in muscle, hemoglobin is classified as a conjugated protein. Conjugated proteins also contain (…….) groups. They are (……) in a number of biological functions. Chlorophyll, the green (……) found in plants, is closely related to heme. But it contains (……) instead of iron.

6. Complete the following sentences. Use the vocabulary from the text.

a) Each of the four hemes contains …
b) Some proteins also…
c) Peptides are…
d) Some proteins are …
e) Proteins fall into…
f) Glycine is…
g) They also have an essential role …

7. Write down the synonyms for the following words.

Example, carries, contain, link, sequence, control.

8. Give opposites of the following words.

Quaternary, also, the green pigment, distortions, between, neighboring, primary.

9. Make a plan of the text and give a summary to cover the topic "Amino acids and proteins"

10. ***Watch the video and answer the questions.***

1. Which biological processes are the proteins involved?
2. How many atoms does the protein molecule contain?
3. What are proteins made of?
4. What are polypeptide chains?
5. What roles do proteins play?
6. Describe the structure of an amino acid.
7. What is the function of chaperonin?

Unit 11

BIOCHEMICAL ENERGY

Energy is needed for nearly all the vital processes that take place in animals and plants. All the energy used by animals is ultimately derived from plants eaten as food. Plants and many bacteria are able to trap light (or occasionally, chemical energy). They use it to convert inorganic materials, such as carbon dioxide and water, into complex organic products. This energy is "stored" in carbohydrates and lipids. Carbohydrates and lipids are discussed in previous articles in this section on biochemistry. The stored energy can then be used to do work in the organism. This may be the chemical work of the biochemical processes, electrical work in nerve cells, or mechanical work in the muscles. The amount of energy needed obviously depends on the size and complexity of the organism. But the levels of physiological and physical activity are also important. For example, the energy requirements of a sleeping human being may increase tenfold or more during limes of strenuous exercise.

Anabolism and catabolism

Metabolism is the network of biochemical reactions that underlies living processes. It consists of constructive (anabolic) and destructive (catabolic)

pathways. The breaking, down of large molecules into smaller units releases energy that maybe used to build other large units. Many thousands of these reactions are going on in the body all the time. The pathways for particular types of molecules, such as proteins or carbohydrates, do not remain separate. They converge so that energy can be released from any available fuel. Similarly, in anabolic processes, a particular compound in excess can be converted to a different material for use in growth or for storage. This flexibility ensures that anabolic and catabolic processes are in balance in a normal organism.

The role of ATP

Adenosine triphosphate (ATP) is a relatively simple compound derived from the purine base adenine. It consists of adenosine (adenine and the sugar ribose) linked to three phosphate groups. ATP is the readily accessible energy used by all plants, animals, and bacteria. The ending phosphate group can be broken off. ATP thus becomes ADP, adenosine diphosphate. ADP is energy available for immediate use. For example, this could be energy (or electrical or mechanical work. Or it could be energy to form chemical bonds in new molecules, which may thus store some of the energy released from the ATP. Alternatively, the energy released in other reactions can be used to convert ADP back to ATP. Hence, ATP provides "ready cash" for the organism to spend or save in its "bank account" of carbohydrates and lipids. Energy is also stored in proteins. This is called upon to some extent during fasting. Protein energy can become the only energy source during starvation, when other resources are exhausted. Some other compounds also contain energy-transferring phosphate bonds, particularly creatine phosphate. This compound provides an emergency reserve to regenerate ATP rapidly in contracting muscle. In terms of an organism's total energy output, however, these compounds are of only minor importance.

ATP is produced from ADP by a highly complex sequence of reactions that is essentially the same in all organisms. The breakdown of ATP releases energy. So the forming of ADP must involve the input of the same quantity of energy. The energy is produced by the gradual oxidation of molecules. These molecules include hexose sugars and fatty acids, even though these may have been made originally by breaking down other molecules. Eventually, the molecules used to produce ATP are oxidized to carbon dioxide and water, just as they would be if burnt directly in air. For this reason, cellular respiration ('breathing") is often referred to as "burning" food. This description is slightly misleading. Direct oxidation involves the production of heat energy, which is of only limited use to a cell. An excess of heat energy would be damaging. Instead, cell respiration involves the gradual stripping away of hydrogen atoms from the foodstuff and the controlled transfer of this hydrogen to oxygen. In this way, the production of water is coupled with the release of small "packets" of chemical energy. Thus, the conversion is more controlled than it would be in a single-step reaction. It is also a more efficient source of useful energy.

VOCABULARY

vital process – життєвий процес
derived – похідний
complexity – складність
constructive – будівний
destructive – руйнівний

1. Translate the following words.

Metabolism, constructive, destructive, carbohydrates, anabolic processes, normal organism, purine.

2. Find English equivalents for the following Ukrainian word-combinations.

Життєві процеси, здатний, взяти, перетворити, вуглевод, нервові клітини, механічна роота.

Answer the following questions to check your understanding of the text.

a) What is the Biochemical energy?
b) What is the metabolism?
c) What is the anabolism?
d) What is the catabolism?
e) What is the ATP?
f) What is the role of ATP?

3. Translate the following sentences.

The production of ATP is accompanied by a «sequence of reactions. In this sequence, the hydrogen atoms shed by the foodstuff are passed between compounds known as hydrogen carriers. In fact, some of the compounds do not accept hydrogen atoms. They accept only electrons from the hydrogens. This results in the release of hydrogen ions-electrically charged hydrogen atoms. These com-pounds are called electron carriers. They contain iron or copper atoms that take up or pass on the electrons. Hydrogen and electron carriers first receive two hydrogen atoms or electrons. They then return to their original from by passing the atoms or electrons on to the next carrier.

The first carrier is called nicotinamide ade-nine dinucleotide (NAD), derived from the vitamin nicotinic acid. This accepts hydrogen from foodstuffs, then passes it on to ihe next carrier. This carrier is a derivative of vitamin B (riboflavin) called flavine mononucleotide (FMN). This in turn accepts the hydrogen and then passes it on to the next carrier. The final set of carriers is in the enzyme cytochrome oxidase, which transfers electrons to oxygen atoms. The resulting oxygen ions then combine with hydrogen ions taken up from the medium to form water. This entire respiratory chain is built into the structure of certain membranes

in the cell. The chain is subdivided into three spans. As two hydrogens or electrons cross each span, the energy released is used to make one molecule of ATP. Thus, ihe complete oxidation just described yields three molecules of ATP.

4. Insert the missing words. Be sure that you understand the text.

ATP is produced from ADP by a highly complex (…….) of reactions that is essentially the same in all organisms. The (…….) of ATP releases energy. So the forming of ADP must (….) the input of the same quantity of energy. The energy is produced by the gradual (…….) of molecules. These molecules include (……) sugars and fatty acids, even though these may have been made originally by breaking down other molecules. Eventually, the (…….) used to produce ATP are oxidized to carbon dioxide and water, just as they would be if burnt directly in air. For this reason, cellular respiration ('breathing") is often (…….) to as "burning" food. This (……) is slightly misleading. Direct oxidation involves the (…….) of heat energy, which is of only limited use to a cell. An excess of heat energy would be damaging. Instead, cell (……) involves the gradual stripping away of hydrogen atoms from the foodstuff and the controlled transfer of this hydrogen to oxygen. In this way, the (…….) of water is coupled with the release of small "packets" of chemical energy. Thus, the (…….) is more controlled than it would be in a single-step reaction. It is also a more efficient source of useful energy.

5. Complete the following sentences. Use the vocabulary from the text.

a) Carbohydrates and lipids are …
b) The breaking, down of large…
c) ATP is the readily accessible energy…
d) Energy is…
e) This description is…
f) The chain is…

7. Write down the synonyms for the following words.

Ultimately, derive, convert, complex, obviously, levels, requirements.

8. Give opposites of the following words.

Nearly, all, take, inorganic, activity, sleeping, increase.

9. Make a plan of the text and give a summary to cover the topic "Biochemical energy".

10. Watch the video and answer the questions.

1. Which parts can the ingested food be broken down to?
2. What are the components of fats?
3. What elements can carbohydrates be broken down to?
4. What are the components of proteins?
5. What happens in the second stage?
6. What are the titles of four stages in biochemical gas production?

Unit 12

BIOCHEMICAL MESSENGERS

Hormones are chemical messengers. They are made in minute quantities in one part of a multicellular organism. They are then transported to a target ceil in another part. There, they stimulate a particular biochemical or physiological activity. In vertebrates (animals with spines), they are formed in endocrine, or ductless glands. These glands empty directly into the bloodstream. Hormones are also known to occur in some invertebrates (not having spines), such as insects. Similar compounds, called phytohormones, control activities such as growth and flowering in plants.

Hormones are produced in such small quantities that they have proved difficult to isolate for studies on their structure and function. But modern techniques are rapidly increasing knowledge of their action on the target cells. Hormones are generally stored in an inactive form in the cells of the endocrine glands located in the head, neck, and torso. They are released following the arrival of appropriate nerve impulses.

A hormone is carried in the blood to a receptor on the target cell. The interaction of the hormone with its receptor may then cause the release of a second messenger. This second messenger either regulates an enzyme pathway or controls the genes that code for that enzyme. The compound cyclic adenosine monophosphate (c-AMP) is involved in several different hormone activities as the second messenger. It is formed from adenosine triphosphate (ATP), the body's main energy supply. Cyclic-AMP regulates a variety of enzymes that produce cellular response. For example, it may regulate the hormone glucagon to get glycogen ready to release glucose from the liver.

Types of hormones

There are three main classes of hormones in vertebrates. They are the peptide hormones, epinephrine, and the steroids.

The peptide hormones include all those produced in the brain by the hypothalamus and pituitary glands. This class also includes two hormones—insulin and glucagon—made in the pancreas. The pancreas is located behind the stomach. Peptide hormones are proteins containing between three and about 200 amino acid residues. They are frequently active in much smaller concentrations than are other hormones. A deficiency of a particular hormone often results in disease. For example, somatotropin, or anterior pituitary growth hormone, regulates the growth of the body. Its absence causes dwarfism or retarded growth. An excess produces acromegaly, which involves excessive growth of the hands, feet, and facial bones of adults.

The second main class contains the best understood of all hormones, epinephrine. These are amine compounds, which are organic compounds derived from nitrogen. They are discussed in the article "Nitrogen compounds." Epinephrine is produced in the central (medulla) part of the adrenal glands, located above the kidneys. Epinephrine (also called adrenaline) is closely related to the nerve transmitter substance norepinephrine. This demonstrates again the interrelationship between hormonal and neural (nerve) control. Epinephrine prepares the body for an emergency, in common with many other hormones, it acts on several different target organs. It increases the heart rate and blood pressure, releases glucose for energy from the liver, and speeds up the formation of ATP (stored-up energy) in the muscles.

The steroid hormones, the third main class, are produced in several parts of the body, including the gonads (the sex glands) and the outer layer (cortex) of the adrenal glands. Steroids are fatty compounds based on cholesterol. Because they do not dissolve in water, steroids are joined to protein molecules for transportation in the blood.

The structures of steroid hormones are very similar. But their biological effects are extremely diverse. Examples include estrogens produced by the ovaries in females and testosterone produced by the testes in males, Steroids also have other effects on the body. The steroid cortisone is used medically to suppress the immune system, the body's natural ability to fight off disease, Male androgen hormones are used (illegally) by athletes to increase muscle size. Vitamin D is also a steroid, following chemical modification in the body, vitamin D acts as a hormone controlling the manufacture of a protein concerned with the uptake of calcium.

Vitamins are a diverse group of compounds. Their only common characteristic is that they cannot be synthesized (made) by an organism. They are therefore essential ingredients in the diet. However, they are needed only in minute quantities. In the case of water-soluble, vitamins, they usually perform

some function together with an enzyme. Some vitamins, such as vitamin D in humans, can be produced in small amounts by the action of sunlight on the skin. The rest of the requirement has to come from food. Other organisms may not be able to produce a vitamin directly. They obtain it from another organism, for example, bacteria in the intestines obtain vitamins from the host.

VOCABULARY

messenger – носій генетичної інформації
multicellular – багатоклітинний
spine – хребет
endocrine – ендокринний
invertebrate – безхребетний
pituitary – слизеутворюючий
gonad – гонада, статева залоза

1. Translate the following words.
Hormones, chemical messengers, biochemical messengers, multicellular, transported, stimulate, vertebrates.

2. Find English equivalents for the following Ukrainian word-combinations.
Ендокрина система, залози внутрішньої секреції, кровяний потік, безхребетний, фітогормони, тулуб, голова, шия.

3. Answer the following questions to check your understanding of the text.
1. What are the hormones?
2. What are their structure and function?
3. What are the types of hormones?
4. What are their biological effects?
5. What are the steroids?

4. Translate the following sentences.
Vitamins are usually classed according to their solubility (ability to dissolve) in water or in fat. The water-soluble vitamins include the B complex and vitamin C. The fat-soluble vitamins are vitamins A, D, E, and K. These compounds are needed continuously because of the breakdown of existing vitamins in the body. However, it is possible to store certain vitamins in the liver. Excessive amounts of the fat-soluble vitamins can be toxic. But a deficiency is more common. Scurvy (insufficient vitamin C), beriberi (lack of B), and rickets (insufficient vitamin D) are all deficiency diseases.

5. Insert the missing words. Be sure that you understand the text.

Vitamins are a diverse (….) of compounds. Their only common (……) is that they cannot be synthesized (made) by an organism. They are therefore (….) ingredients in the diet. However, they are needed only in minute (….). In the case of water-soluble, (…….), they usually perform some function together with an enzyme. Some vitamins, such as vitamin D in (…….), can be produced in small amounts by the action of sunlight on the skin. The (….) of the requirement has to come from food. Other (……) may not be able to produce a vitamin directly. They obtain it from another organism, for example, bacteria in the (…….) obtain vitamins from the host.

6. Complete the following sentences. Use the vocabulary from the text.

a) They are then transported…
b) Hormones are generally stored in …
c) It is formed from adenosine triphosphate (ATP) …
d) A deficiency of…
e) The second main class contains…
f) Steroids are…
g) But their biological…

7.Write down the synonyms for the following words.

Host, produce, however, modification, main.

8. Give opposites of the following words.

Intestines, directly, small, biological, chemical.

9.Make a plan of the text and give a summary to cover the topic "Biochemical messengers"

10. Watch the video and answer the questions.

1. How does communication between cells start?
2. What is a gap junction?
3. What are surface proteins able to do?
4. How does the paracrine communication happen?
5. What is meant under endocrine signalling?
6. Explain the activity of an autocrine process.
7. What is a ligand?
8. Explain the characteristic of signal transduction.

Unit 13

RADIOACTIVITY AND NUCLEAR REACTIONS

Radioactivity is the spontaneous breakdown of an unstable atomic nucleus with the release of particles and rays.

Radium was discovered by Pierre and Marie Curie in 1898. It is a very radioactive element always found in uranium ores. Radium resembles barium in its chemical properties. Radioactive nuclides and their compounds have several unusual properties: (1) they affect the light-sensitive emulsion on a photographic film, (2) they produce an electric charge in the surrounding air, (3) they produce fluorescence with certain other compounds, (4) their radiations have special physiological effects, (5) they undergo radioactive decay. The half-life of a radioactive nuclide is the length of time that it takes for half of a given number of atoms of the nuclide to decay.

The radiation given off by radioactive nuclides consists of three different kinds of particles and rays: (1) alpha particles, which are helium nuclei; (2) beta particles, which are electrons; and (3) gamma rays, which are high- energy X rays. The emission of these particles from the nuclei of radioactive nuclides causes the nuclides to decay into simpler ones.

The age of certain minerals and of carbon-containing materials can be estimated by the amounts of radioactive nuclides they contain.

The difference between the sum of the masses of the separate particles making up a nucleus and the actual mass of a nucleus is the nuclear mass defect.

There are four types of reactions that nuclei undergo to become more stable: (1) radioactive decay, (2) nuclear disintegration, (3) fission, and (4) fusion.

A nuclear reactor is a device in which the controlled fission of radioactive material produces new radioactive substances and heat energy, which may be used to generate electrical power.

A fusion reaction is one in which lightweight nuclei are combined into heavier nuclei. Fusion reactions produce the sun's heat and light.

VOCABULARY

alpha particle- альфа частка
beta particle- бета частка
fission – розщеплення, поділ
fluorescence – свічення
gamma ray- гамма випромінювання
nuclear disintegration – ядерний розпад
nuclear mass defect – недолік ядерної маси
radioactive decay – радіоактивний розпад

1. Read the text carefully and answer the following questions:

a) What is the radioactivity?
b) Who was radium discovered by?
c) What is the difference between the sum of the masses of the separate particles making up a nucleus and the actual mass of a nucleus?
d) What kinds of particles and rays do you know?
e) What is a fusion reaction?
f) What is the nuclear reactor?
g) What are the types of reactions that nuclei undergo to become more stable?

2. Explain the meaning of the underlined terms? Or look them up in the explanatory dictionary.

3. Make a terminological vocabulary: find and write down all terms from the text, relating to the topic, and translate them into Ukrainian.

4. Translate the following words and collocations into Ukrainian.

Radioactive material, lightweight nuclei, undergo, more stable, separate particles, helium nuclei, electrons, physiological effects, breakdown, unstable atomic nucleus.

5. Translate the following words and collocations into English. Then make a sentence with each of them.

Плавлення, ізотоп, ядерний реактор, радіоактивність, випромінювання, уранова руда, схожий, барій, виділення, речовина.

6. Complete the following sentences. Use the vocabulary from the text.

a) Radioactive nuclides and their compounds have.…
b) The radiation given …
c) The age of …
d) The difference between …

e) There are four types …
f) A nuclear reactor …
g) A fusion reaction …

7. Make a plan of the text and give a summary to cover the topic "Radioactivity and nuclear reactions''

8. Watch the video and answer the questions.

1. What is a strong nuclear force?
2. Which process do chemists call "radioactivity"?
3. What does radioactive decay mean?
4. Explain the concept "the rate of decay".
5. How long can nuclear energy power entire cities?
6. What is the impact of radiation poisoning on the human body?
7. Give examples of useful using of radioactivity.

Освітня програма «Хімічні технології переробки полімерних композиційних матеріалів»

Unit 14

Polymeric Materials

Life depends fundamentally on organic polymers. These polymers provide not only food but also clothing, shelter and transportation.

Indeed, nearly all the material needs of man could be supplied by natural organic products. The list of these materials and things made of them might be very long: wood, fur, leather, wool, cotton, silk, rubber, oils, paper, paints and so on. The organic polymers from which such things could be made include proteins, cellulose, starch, resins and few other classes of compounds.

Modern methods of physical and chemical analyses have uncovered the principles that govern the properties of the natural polymers. A new industry of man-made organic polymers has appeared. One could list the principal products such as fibres, synthetic rubbers, coating, adhesives and a lot of materials called "plastics". Plastics and synthetic coating are already in common use.

Synthetic polymers now available already possess several of the properties required in a structural material. They are light in weight, easily transported, easily repaired, highly resistant to corrosion and solvents, and satisfactory resistant to moisture. It would be necessary to add that they have long-lived durability and resistance to high temperatures. A very important question could arise whether synthetic polymers could be made inexpensive enough to complete

with the structural materials such as metals and ceramics. The answer could be: "yes".

Natural substances can't be like polymers in lightness, strength, chemical durability, ability to absorb vibrations and reflect, stop or let through sound or radio waves or nuclear radiation. Polymers can be porous or monolithic, transparent or opaque. They have long been used as excellent electrical insulators.

It might seem odd that man came rather late to the investigation of organic polymers as the principal means of supporting life. The natural polymers such as proteins, cellulose and others dominated his existence and even in ancient times people used these materials.

It was only in the 20th century that the scientists began thorough investigation of these materials. Having used some powerful physical instruments, an electron microscope, viscometer, X-ray-diffraction apparatus, they could have revealed the polymers in all their intricacy. Their molecules were incredibly large, the molecular weight running as high as millions of units, whereas simple organic substances such as, for instance, sugar and gasoline have molecular weights in the range of only about 50-500.

The giant molecules can be composed of a large number of repeating units, they being given the name "polymer" from the Greek words "poly" – many and "meros" – a part. Most polymers have the form of long flexible chains. Having found out that, chemists began synthesizing artificial polymers. This has led to the establishment of industries producing synthetic fibres and numerous polymeric materials, many of which were less expensive and superior in various ways to the natural materials.

As for plastics themselves, there are two kinds – those which are affected by heat and those which are not, or cast plastics and moulded plastics. Cast plastics are manufactured as liquid resins and are then cast in the desired forms. Moulded plastics are usually mixed with "fillers" to strengthen the finished material and give certain characteristics.

Now it is quite clear that the production of synthetic polymers is very important.

Scientists work hard at this problem. It is quite clear that science will continue to create new polymers and our industry and agriculture will receive cheap new materials with valuable properties.

1. New words and word-combinations to be remembered.

wood – деревина
fur - хутро
leather - шкіра
rubber - гума, каучук
resin - смола
paint - фарба

property - властивість
fibre - волокно
coating - покриття
starch - крохмаль
adhesive - клей
to possess - володіти, мати
resistant - стійкий, витривалий
solvent - розчинник
inexpensive - дешевий, недорогий
long-lived durability - витривалість
to compete with - конкурувати з
investigation - дослідження
support - підтримувати
chain reaction - ланцюгова реакція
valuable - цінний
cast - лиття
to mould - формувати під тиском
compound - сполука
artificial - штучний
weight - вага
intricacy - плутанина, складність

2. Answer the following questions.

1. What does life fundamentally depend on?
2. What do polymers provide?
3. What can be made of organic polymers?
4. How has a new industry of man-made organic polymers appeared?
5. What are the properties of synthetic polymers?
6. What is the difference between natural substances and polymers?
7. When did scientists begin the investigation of organic polymers?
8. What are the two kinds of plastics?

3. Read the text and mark the following sentences as true (T) or false (F).

1. Nearly all the material needs of man could be supplied by natural organic products.
2. The principles that govern the properties of the natural polymers are still unknown.
3. Synthetic polymers are heavy and have low resistance to corrosion.
4. Synthetic polymers have long-lived durability and resistance to high temperatures.
5. Synthetic polymers couldn't be made inexpensive enough to complete with the structural materials such as metals and ceramics.

6. Polymers can be porous and transparent, but can't be monolithic and opaque.
7. Natural substances can't be like polymers in lightness, strength, chemical durability, etc.
8. Polymers have long been used as excellent electrical insulators.
9. The investigation of organic polymers as the principal means of supporting life began several centuries ago.
10. In ancient times people used such natural polymers as proteins and cellulose.
11. The giant molecules of polymers can be composed of a large number of repeating units.
12. Most polymers have the form of short firm chains.

4. a) Fill in the words from the list to make phrases.

Polymers; durability; radio; radiation; electrical; ancient; electron; weight; flexible; synthetic; resins; moulded.

1 molecular……
2 ……..…..plastics
3 long……..……chains
4 liquid……..……
5 ……..……fibres
6 ……microscope
7 ……...……times
8 …….…….waves
9 ……...….insulators
10 organic…….
11 nuclear…….
12 long-lived ..…….….

5. Make up the plan and retell the text according to it.

6. Write the summary of the text.

7. *Watch the video and answer the questions.*

1. Give the definition of a "polymer".
2. How to calculate the molecule weight?
3. What does the degree of polymerisation denote?
4. Give the definition of a "monomer".
5. What kind of bonds do monomers have?
6. Describe the characteristic features of oligomers.

Unit 15

History and Significance of Polymers

What is a polymer? The simplest definition of a polymer is something made of many units. The units or "-mers" are generally hydrocarbons or derivatives joined together in distinct repeating patterns. Think of a polymer as a chain. Each link of the chain is the "mer" or basic unit, which is made of carbon, hydrogen, oxygen, and/or silicon. To make the chain, many links or "-mers" are hooked or polymerized together. Polymerization can be demonstrated by linking strips of construction paper garlands or hooking together hundreds of paper clips to form extended chains. Further investigation of the chemistry of polymers will come, but first a look into the history of these materials.

Some polymers are natural substances that come from vegetable and animal sources. They include horns of animals, tortoise shell from the hawksbill turtle, shellac from the secretions of an Asiatic insect called a lac, rosin from the sap of pine trees, asphalt from decayed plants and animals, and tar from the distillation of organic materials such as wood. Other natural polymers you may not be as familiar with include amber, which is the fossilized resin of trees, or lignin, which is the fibrous binding between wood cells. What makes these polymers unique is that they can be used or processed into usable articles by the application of only heat and/or pressure. Common uses of these natural polymers include fans and hair ornaments, which can be made from tortoise shell. Buttons, beads, knife handles, and jewelry can be made from horn and from amber. Bowlers, dancers, violinists, baseball players, and gymnasts all use natural polymer rosin in their sport or profession.

Shellac was used by the Chinese as early as the fifteenth century to create beautiful artwork, although more familiar is shellac's use as a wood finish. A comb-making company that used natural polymers was probably the first polymer industry in the United States, dating back to 1760.

By the turn of the nineteenth century, a new development was about to occur that would change the infant polymer industry dramatically. The change occurred when natural polymers were processed or reacted with chemicals to make them useful substances. These polymers are called 'modified natural polymers' or 'semi-synthetic polymers'. The first and most famous of these is vulcanized

rubber. In 1839, Charles Goodyear discovered, after years of experimentation, that the sap of the hevea tree (latex) could be heated with sulphur to permanently alter the physical properties of the latex. Until this discovery, rubber had limited usefulness because it was brittle in the cold and melted when the temperatures became warm.

Additional natural source polymers include gutta percha, gun cotton, celluloid, casein, parkesine, and guayule. Gutta percha, the latex of the Malaysian gutta tree, was first used by George Montgomery for whip and knife handles. Because of its waterproof nature, gutta was then used to cover the first trans-Atlantic cable in 1843. Today, gutta percha is the material dentists use to fill the canal of a tooth during a root canal. Wood pulp and cotton linters are the natural source for many plastics, such as gun cotton (a Civil War explosive), parkesine and celluloid (plastics very similar to ivory that were developed in the 1860s), cellulose acetate (used for films and fibers), and many others. Milk is the natural source for casein, which has been used for buttons, moldings, and adhesives. The latex of the guayule bush, which is very similar to the latex of the hevea tree, was investigated as a replacement for hevea latex in rubber production in the 1940s. Not only were the scientists of the 1800s developing modified natural polymers, they were also trying to duplicate the structure of the structure of natural substances, in hopes of producing synthetic counterparts.

1. Words and word-combinations to be remembered.

derivative – похідний
distinct – чіткий, певний
chain – ланцюг
hooked – зчеплений
strips – смужки, стрічки
extended – простягнутий, подовжений
hawks bill – дзьоб яструба
shellac – шелак; вкривати шелаком
insect – комаха
lac- червона смола, фарба або лак з неї
sap – сік рослин, живиця
fossilized – скам'янілий
rosin – смола, каніфоль; натирати каніфоллю
brittle – крихкий, ламкий
whip – батіг
molding – карниз, ліпнина
adhesive – липкий
counterpart – копія, дублікат

2. Answer the following questions.

1. What is a polymer?
2. What do some polymers as natural substances come from?
3. What do natural polymers include?
4. What makes natural polymers unique?
5. What can be made from horn and amber?
6. Where was shellac used in the fifteenth century?
7. What polymers are called “modified natural polymers”?
8. What did Charles Goodyear discover in 1839?

3. Mark the following sentences as true (T) or false (F).

1. Each link of the polymer chain is the basic unit, which is made of nitrogen, silicon and chlorine.
2. Many links are hooked together to make the chain.
3. Polymerization can be demonstrated by hooking together hundreds of paper clips to form extended chains.
4. All natural polymers come from vegetable sources.
5. Natural polymers can be processed into usable articles by the application of only cold.
6. Buttons, beads, knife handles, and jewelry can be made from horn and amber.
7. A British comb-making company that used natural polymers was probably the first polymer industry in the country.
8. A new development that would change the infant polymer industry was about to occur by the turn of the nineteenth century.
9. The first and the most famous of modified natural polymers is vulcanized rubber.
10. Charles Goodyear discovered that the sap of the pine tree could be heated with sulfur to permanently alter the physical properties of the latex.
11. Rubber was widely used before Charles Goodyear’s discovery.
12. The natural source for casein is meat.

4. a) Fill in the words from the list to make phrases.

Unit; paper; handles; fossilized; wood; company; substances; vulcanized; hevea; cable; cellulose; polymers.

1. useful …….
2. ……. tree
3. ……. acetate
4. basic……
5. comb-making….
6. semi-synthetic….
7. ……. clips
8. ……. resin
9. ……...rubber
10. knife ……
11. ……. cells
12. trans-Atlantic ….

b) Make sentences using the completed phrases.

5. Find in the text and translate into Ukrainian appropriate nouns to the following verbs.

To derive; to polymerize; to construct; to investigate; to distil; to apply; to press; to develop; to discover; to use; to produce.

6. Match the word-combinations with their Ukrainian equivalents.

1) Simple definition
2) Animal sources
3) Further investigation
4) Paper garlands
5) Fibrous binding
6) Tortoise shell
7) Beautiful artworks
8) Wood finish
9) Additional source
10) Waterproof nature
11) Synthetic counterparts

a) Прекрасні витвори мистецтва
b) Додаткове джерело
c) Водонепроникна природа
d) Кінцева обробка деревини
e) Подальше дослідження
f) Синтетичні копії
g) Просте визначення
h) Панцир черепахи
i) Волокнистий зв'язок
j) Паперові гірлянди
k) Тваринні джерела

6. Retell the text according to the plan.

1) What is a polymer?;
2) polymerization;
3) natural polymers;
4) semi-synthetic polymers;
5) latex;
6) other natural source polymers.

7. Write a summary of the text.

8. Watch the video and answer the questions.

1. Give examples of things which have polymers in their structure.
2. Who and when first proposed the structure of polymers?
3. Who and when produced the first industrial plastic?
4. What are the advantages of polymeric materials?
5. Why is 1966 an important year for polymeric materials?
6. Why do people have growing concern about using polymers?

Unit 16

Characteristics of Polymers

The two major groups of polymers are thermoplastics and thermosets. Thermoplastic and thermosetting nature is based on the heat response of polymers. The light transmittance of polymers includes the description of materials as being transparent, translucent, or opaque. Transparent polymers are those that you can see through, translucent are those that you cannot see trough but allow light to pass through, and opaque polymers are those that you can neither see trough nor allow light to pass through. Light penetration qualities are dependent on the degree of crystallization of the polymer and the presence of additives. Every polymer has very distinct characteristics but most polymers have the following general attributes.

1. *Polymers can be very resistant to chemicals.* Consider all the cleaning fluids in your home that are packaged in plastic. Reading the warning labels that describe what happens when the chemical comes in contact with skin or eyes or is ingested will emphasize the chemical resistance of these materials.

2. *Polymers can be both thermal and electrical insulators.* A brief trip through your house will reinforce this concept, as you consider all the appliances, cords, electrical outlets, and general wiring that are made of or covered with polymeric materials. Thermal resistance is evident in the kitchen with pot and pan handles made of polymers, with the foam core of refrigerators and freezers, and with insulated cups, coolers, and microwave cookware. The thermal underwear that many skiers wear is made of polypropylene, and the fiberfill a winter jacket can be made from polypropylene or polyester fiber.

3. *Generally, polymers are very light in mass with varying degrees of strength.* Consider the range of applications from a dime store toy to the frame structure of space stations, or from delicate nylon fiber used to make pantyhose to Kevlar, which is used in bulletproof vests.

4. *Polymers can be processed in various ways to produce thin fibers or very intricate parts.* Plastics can be molded into bottles or the body of a car be mixed with solvents to become an adhesive or paint. Elastomers and some plastics stretch and are very flexible. Other polymers can be foamed, like polystyrene (Styrofoam) and urethane, to give just two examples.

Polymers are materials with a seemingly limitless range of possible characteristics, and colors. Polymers have many inherent properties that can be enhanced by a wide range of additives to broaden their use and applications. The ability to design or engineer the polymer for each specific application makes plastics unique among basics material types.

Each polymer resin can be identified by fundamental identification tests. Melting point, burning properties, solubility, relative density, and halogen tests can identify resins in a lab. When testing the resins, be sure to use safety goggles and perform the tests in a lab fume hood.

1. New words and word – combinations to be remembered.

transparent – прозорий
translucent – що просвічує, напівпрозорий
opaque – матовий
penetration – проникнення
additive – додавання
resistant – стійкий
fluid - рідина
warning - попередження
ingest – ковтати
insulator – ізолятор
to reinforce – укріплювати
appliances – прилади
outlets – розетка (електрична)
dime – десятицентова монета
frame – каркас, рама
bulletproof vest – куленепробивний жилет
intricate – цікавий
mold – форма, пліснява; формувати, ліпити
adhesive – клейкий, липкий; клей
enhance – збільшувати
solubility – розчинність
density – щільність
fume hood – димохід

2. Answer the following questions.

1. What are the two major groups of polymers?
2. What is the difference between transparent, translucent and opaque polymers?
3. What examples of polymers resistance to chemical do you know?
4. Can polymers be thermal or electrical insulators?
5. Where is thermal resistance of polymers evident?
6. Are polymers heavy in mass?
7. Can fibers be made of polymers?
8. What can each polymer resin be identified by?

3. Mark the following sentences as true (T) or false (F).

1. Thermoplastic and thermosetting nature is based on the heat response of polymers.
2. Transparent polymers are those you cannot see through, but allow light to pass through.
3. Opaque polymers are those you can neither see through nor allow light to pass through.
4. Translucent polymers are those you can see trough.
5. Light penetration qualities depend on the degree of crystallization of the polymer.
6. Every polymer has very distinct characteristics.
7. We cannot keep cleaning fluids in plastic bottles because of their low resistance to hemicals.
8. If you ingested some chemicals, it would be safe to your health.
9. Polymers can be used in the kitchen because of their high resistance to the heat.
10. The thermal underwear that many skiers wear is made of polyethylene.
11. Polymers are light in mass with varying degrees of strength.
12. Plastics can be mixed with solution to become an adhesive or paint.

4. a) Fill in the words from the list to make phrases.

Response; light; crystallization; distinct; attributes; cleaning; chemical; insulators; electrical; cookware; bulletproof; parts.

1 ……. characteristics
2 thermal…….
3 intricate…….……
4 heat……..…….
5 ……. vests
6 microwave……
7 ……..... penetration
8 general…….…….
9 degree of…..……
10 ……. fluid
11 ……..……. outlets

12 ……. Resistance

b) Make sentences using the completed phrases.

5. Find in the text words to complete the sentences.

1. Polymers that you can see trough are called …
2. Polymers you cannot see trough but allow light to pass trough are called …
3. Polymers that you can neither see trough nor allow light to pass trough are called …
4. Polymers can be very resistant to …
5. … resistance is evident in the kitchen with pot and pan handles made of polymers.
6. The thermal … that many skiers wear is made of polypropylene.
7. Plastics can be … into bottles or the body of a car.

6. Find in the text the appropriate nouns to the following verbs.

To describe; to penetrate; to crystallize; to be present; to add; to resist; to apply; to cool; to characterize.

7. Retell the text according to the plan.

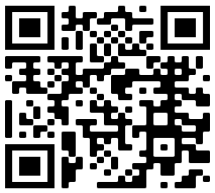
1) The 2 groups of polymers;
2) resistance to chemicals;
3) thermal and electrical insulation;
4) mass and strength;
5) using of polymers.

8. Write a summary of the text.

9. Watch the video. Explain and give definitions of the following properties of polymers:

- Heat capacity/heat conductivity
- Thermal expansion
- Crystallinity
- Permeability
- Elastic modulus
- Tensile strength (give examples of polymeric materials with high tensile strength)
- Glass transition temperature
- Resilience
- Toughness
- Refractive index
- Resistance to electric current

Unit 17



Plastics in our oceans

Strolling through the average supermarket, shoppers find literally hundreds (if not thousands) of items to make their lives easier. Individually wrapped snack cakes, plastic baggies to store sandwiches for lunch, unbreakable soda bottles. Unless specifically requested, even the bags we use to carry home our goods are often plastic.

To humans, these are items of comfort, if not necessity. But to marine animals, they can be a floating minefield.

Plastic-whether it is for a container, a wrapped, or the product itself-has become an everyday part of our lives. This isn't necessarily a bad thing- plastic is also the material diabetics use for their disposable syringes; arthritic patients have for their replaced hips; and construction workers wear to protect their heads.

But when plastic reaches our water, whether it is plastic bags or drifting fish nets, it poses a threat to the animals that depend on the oceans for food. To a sea turtle, a floating plastic bag looks like a jellyfish. And plastic pellets-the small hard pieces of plastic from which plastic products are made-look like fish eggs to seabirds. Drifting nets entangle birds, fish and mammals, making it difficult, if not impossible to move or eat. As our consumption of plastic mounts, so too does the danger to marine life.

Before the days of plastic, when fishermen dumped their trash overboard or lost a net, it consisted of natural materials-metal, cloth or paper that would either sink to the bottom or biodegrade quickly. But plastic remains floating on the surface, the same place where many genuine food sources lie-and can remain so for 400 years. Plastic is durable and strong-precisely the qualities that make it so dangerous if it reaches the ocean.

But how would a syringe that a diabetic uses make it into the ocean? If plastic objects make it into the main sewer system (say, by being flushed down the toilet, or carried by the rain into a street drain), and the water treatment plants are overwhelmed by excessive rain, then those floating objects can float right out to sea. This is precisely what happened on the New York and New Jersey beaches in 1988, when medical waste was floating up onshore. After an unusually dry spring, litter began

accumulating on the streets and in storm sewers. When heavy rains arrived in mid-summer, they swept the streets clean and overloaded combined sewers. After floating out to sea, the debris was blown back onto the shores.

In a more direct route, boaters may dump their trash right into the sea. In the past, this has been the main cause of plastics in the ocean. In 1975, the National Academy of Sciences estimated that 14 billion pounds of garbage was being dumped into the ocean every year. That's more than 1.5 million pounds per hour. More than 85% of this trash was estimated to come from the world's merchant shipping fleet in the form of cargo-associated wastes. According to the Academy, the United States could be the source of approximately one third of this ocean pollution.

Fortunately, since the last day of 1988, it has been illegal for ships to dump plastics into the ocean. But that law is difficult to enforce, and cannot account for the thousands of miles of driftnets and other gear set by fishermen, which can ensnare and kill birds diving for the fish below, or come loose, only to be discovered later by an unfortunate humpback whale.

1. Words and word combinations to be remembered.

strolling - прогулюючись
wrapped - загорнутий
disposable - одноразовий, одноразового використання
diaper - підгузок
floating minefield - плаваюче мінне поле
syringe - шприц
hips - стегна
threat - загроза
jellyfish - медуза
pellet - кулька
drifting - дрейфуючий
entangle – заплутувати
mammals - ссавці
dumped - викинутий
trash - сміття
genuine - щирий, справжній
precisely - точно, рівно
sewer - каналізаційна труба
drain - водостік
overwhelmed - переповнений
excessive - надмірний
ensnare - пастка, капкан

2. Answer the following question.

1. What things can shoppers find in the supermarket to make their lives easier?
2. What are the bags to carry home the goods made of?

3. What can be items of people's comfort to marine animals?
4. How dangerous can plastic be to the animals?
5. Why is plastic dangerous to marine life?
6. What happened on the New York and New Jersey beaches in 1988?
7. What has been the main cause of plastics in the ocean?
8. When did it become illegal for ships to dump plastics into the ocean?

3. Mark the following sentences as true (T) or false (F).

1. Strolling through the average supermarket, shoppers can find a lot of items to make their lives easier.
2. People seldom use plastic bags to carry home goods.
3. Plastic things can be a floating minefield to humans, but to marine animals these are items of necessity.
4. Plastic has become an everyday part of our lives.
5. Plastic is used in medicine for disposable syringes and replaced joints.
6. When plastic reaches our waters, it becomes food to animals.
7. Plastic pellets look like birds' eggs to fish.
8. Before the days of plastic, fishing nets consisted of natural materials.
9. The durability and strength make plastic very dangerous if it reaches the ocean.
10. Plastic objects cannot reach the ocean by being flushed down the toilet.
11. In 1975 it was estimated that more than 1.5 million pounds of garbage per hour was being dumped into the ocean every year.
12. Since the last day of 1988 it has been legal for ships to dump plastics into the ocean.

4. a) Fill in the words from the list to make phrases.

Plastic; syringes; replaced; marine; turtle; nets; floating; rain; ocean; drain; waste; system.

1 medical …...……
2 excessive ……...
3 sea ……..……
4 ……. bags
5 sewer ……..…
6 ……. pollution
7 drifting ……..…….
8 disposable ……..
9 street ……..…….
10 ……... minefield
11 ……. …...animals
12 ……..……hips

b) Make sentences using the completed phrases.

5. Match the words with their definitions.

1. pollution	a) things that you through away, such as empty bottles, used papers, food that has gone bad, etc.;
2. hip	b) something used for catching fish, insects or animals which is made of threads woven across each other;
3. plastic	c) an instrument for taking flood from someone's body or putting liquid, drugs etc. into it;
4. trash	d) a light strong material that is produced by a chemical process;
5. surface	e) a pipe or passage under the ground that carries away waste material and used water from the houses, factories, etc.
6. mammal	f) the process of making air, water, soil etc. dangerously dirty;
7. threat	g) a type of animals that drinks milk from its mother's body when it is young;
8. sewer	h) one of the two parts on each side of your body between the top of your leg and your waist;
9. syringe	i) the possibility that something very bad will happen;
10. net	j) the outside or top layer of something.

6. Put the following words into the correct columns.

Average; razor; disposable; carry; often; plastic; syringe; arthritic; worker; protect; pellet; difficult; biodegrade; genuine; precisely; reach; float; unfortunate; enforce.

Noun	Verb	Adjective	Adverb

7. Make up the plan and retell the text according it.

8. Write a summary of the text.

9. Watch the video "Clearing The Great Pacific Garbage Patch. The Ocean Cleanup" and answer the questions.

1. What is Boyan Slat'job?
2. What is the mission of the organisation "The Ocean Cleanup"?
3. What is the territory of the Great Pacific Garbage Patch?
4. What is it made of?
5. How many species are affected by marine debris?
6. How many bird die every year because of plastics?
7. How does the system "002Jenny" work?
8. What is the project "003Jenny" about?

Unit 18

Plastics in electronics

This is, indeed, the age of electronics. Computers power the business world and teach skills to toddlers. Communications systems reach the far comers of the earth and beyond. Tasks that once took long, hard hours now can be accomplished in a few minutes. Painful and dangerous medical procedures have been eliminated. And our leisure hours have more variety than ever before. Everywhere we look, an ever-growing universe of electronic equipment, components and gadgets is expanding our world and improving our lives.

Without plastics, little of it would exist. In electrical and electronic uses in the home, their wide range of properties enable plastics to play a variety of roles, making our personal lives easier, safer, less expensive and more fun.

Plastics with premium thermal and insulating properties are used to insulate nearly all house wiring today and also are used in electric switches, connectors and receptacles throughout the home.

Lightweight, durable, attractive and cost-effective plastics are used in nearly all of our small appliances, including coffee makers, irons, mixers, can openers, hair dryers and shavers. Appliances such as microwave ovens and food processors use plastics to offer consumers unprecedented convenience. All refrigerators today are insulated with thermal-efficient plastic foam, and their interiors are made of durable, easy-to-clean plastics. And other major appliances are sporting more and more plastic components.

Smoke detectors made with plastics have become fixtures in today's homes, cutting down on fire deaths and property losses. In addition, plastic pipe is bringing more and more sprinkler systems to private homes, adding to families' protection against the worst threat to them and their homes.

Sophisticated electronic toys are part of many children's lives these days, teaching basic skills as they amuse. Home computers have become common, allowing all members of the family to prepare lessons, plan budgets, keep up correspondence, play games and do work at home. All these amazing machines depend on plastic housings, circuit boards, components and packaging to bring their technological wonders into our homes.

Durability and cost saving, parts consolidation and design flexibility, weather ability and chemical resistance – plastics offer it all. And for that reason, the consumer can have it all, as well. Without the use of plastics, the product life of some major appliances would be reduced nearly 50 percent. Today's major appliances would cost at least 25 percent more and use 30 percent more energy than similar products produced without plastics.

Without plastics, most of the electronic products we use today would not have been practical or economical. Designers of computers and business equipment choose plastics for their toughness, durability, ease of fabrication into complex shapes and their electrical insulation qualities. We probably would not have television and other entertainment units in virtually every room, telephones wherever and whenever we want and need them or computer technology at our fingertips.

Plastics have been the building blocks and stepping stones of electronic progress for decades, housing electronics, insulating components from all types of interference and protecting their most delicate and sensitive parts against even the tiniest speck of dust. In fact, microprocessor miniaturization would have been impossible without the qualities and cost effectiveness of plastics.

The continuing miniaturization of circuit boards and components such as computer chips increasingly relies on high-performance plastics to provide tough, dimensionally stable parts that can withstand both the stress of assembly and the

stain of use. With plastics, electronic designers simultaneously can decrease size and increase the functionality of circuitry in consumer, business and industrial electronics.

1. Words and word-combinations to be remembered.

accomplish - закінчувати, досягати
eliminate - ліквідувати, виключати
expand - розширяти, збільшувати
enable - сприяти, давати можливість
insulate - ізолювати
receptacles - ємкість
unprecedented - безпрецедентний
foam - піна, піногума
sporting - давати шанс
fixture - обладнання
sprinkler - розбризкувач, спринклер
threat - загроза
sophisticated - вишуканий
amuse - розважати
circuit - ланцюг
consolidation - укріплення, зміцнення
weather ability - стійкість до зміни погодних умов
toughness - міцність, стійкість
fingertips - кінчики пальців
interference - втручання
speck - плямка, краплинка
rely - довіряти
dimension - вимір, розміри, аспект
assembly - монтаж, зборка
strain - напруга, навантаження, розтягнення, деформація
simultaneously - одночасно
circuit board - монтажна плата

2. Answer the following question.

1. How can the age we live in be named?
2. How have computers changed our life?
3. Would computers change our life?
4. What are modern refrigerators insulated with?
5. Why are plastics used to insulate wiring?
6. What do people use computers for?
7. Why do designers of computers choose plastics?
8. What is the impact of plastics on electronic progress?

3. Mark the following sentences as true (T) or false (F).

1. Communications systems reach the far comers of the earth and beyond.
2. Painful and dangerous medical procedures have become popular.
3. Our leisure hours are more boring now than ever before.
4. An ever-growing universe of electronic equipment is improving our lives.
5. Electronic equipment, components and gadgets could exist without plastics.
6. The wide range of properties enables plastics to make our personal lives easier.
7. Plastics are used in electric switches, connectors and receptacles throughout the home.
8. Plastics aren't used for coffee makers and irons.
9. The interiors of modern refrigerators are made of plastic foam.
10. Electronic toys are part of many children's lives nowadays.
11. Home computers prevent the members of the family to prepare lessons? Plan budgets and do work at home.
12. Most of electronic products we use today would not have been practical or economical without plastics.

4. a) Fill in the words from the list to make phrases.

Medical; equipment; insulating; house; switches; oven; smoke; resistance; miniaturization; board; sprinkler; plastic.

1 ……. detectors
2 circuit …….
3 …… foam
4 microwave …….
5 ……. ….. procedures
6 ……..... properties
7 ……... systems
8 microprocessor ……...
9 electronic …….
10 chemical ……..…
11 ……. wiring
13.electric ……..…….

b) Make up sentences using the completed phrases.

5. Match the words with their definitions.

1. flexibility	a) an electronic machine that stores information and uses programs to help people in their work;
2. entertainment	b) an ability to do something well;

3. wire	c) the tools, machines, clothes etc. that you need to do a particular job or activity;
4. skill	d) a substance which is like a very thick soft liquid with a lot of bubbles in it;
5. computer	e) all space, including all the stars and planets;
6. foam	f) the ability to bend or be bent easily;
7. gadget	g) things such as films, television, performances that are intended to amuse or interest people;
8. speck	h) a very small mark, spot, or piece of something;
9. universe	i) a piece of metal used for carrying electrical currents or signals;
10.equipment	j) a small, useful, and cleverly-designed machine or tool.

6. Decide what parts of the speech these words belong to.

Electronics; electronic; teach; reach; beyond; hard; enable; thermal; insulate; durable; durability; appliance; apply; plastic; threat; worst; common; prepare; reduce; business.

7. Make up a plan and retell the text according it.

8. Write a summary of the text.

9. Watch the video "Plastic Electronics: Inventing the Future" and answer the questions

1. Why is plastics used in electronics?
2. Why conductive and semi-conductive materials used in electronics?
3. How can polymer change colour?
4. What are the unique attributes of plastics?
5. Give examples of future possible use of plastics in electronics

Освітня програма «Технологія та експертиза шкіри і хутра»

Unit 19

Hides and skins

The hides and skins used in the manufacture of leather are generally obtained from animals killed for food. The coverings of large animals are classified as hides, whereas those of small are known as skins.

Hides and skins soon putrefy if allowed to remain in a moist condition, so it becomes necessary to treat them in such a manner that they may be kept undamaged until ready for the tanning processes. This operation, known as curing, may be done in several ways. The pelts of animals come to the tanner in four conditions: 1) green (fresh from the animal); 2) green-salted (where the salt has been rubbed on the flesh- side); 3) dry-salted (rubbed with salt and dried); 4) dried (usually stretched on boards in the sun).

The pelts so received are divided according to size into three general classes: hides, kips and skins.

Hides comprise pelts from large and fully grown animals such as the cow, horse, camel and walrus. These give thick, heavy leather for shoes, shoe soles, machinery belting and other purposes.

Kips are the skins of undersized animals of above species.

Skins are obtained from small animals such as calves, sheep and goats. Kips and skins yield a lighter leather than hides, which is suitable for a great variety of purposes such as uppers for shoes, pocket-books, book bindings, bags, gloves, etc.

1. Words and word-combinations to be remembered.

to putrefy - гнити
moist - вологий
to treat – обробляти
undamaged - непошкоджений
to obtain - отримувати
green (pelt) - парна шкіра
green-salted (pelt) - мокросолена шкіра
dry-salted (pelt) - сухосолена шкіра

2. Answer the questions.

1. What is the classification of the coverings of animals?
2. For what purposes are hides and skins used?
3. Why are hides and skins treated before tanning?
4. In what conditions do the pelts of animals come to the tanner?
5. What three classes are pelts divided into?
6. Which animals are hides obtained from?
7. What sort of leather is obtained from hides and where is it used?
8. What do kips and skins yield?
9. What are uppers for shoes, pocket books and gloves made of?

3. State True or False (T/F).

1. The hides and skins are used in the manufacture of leather.
2. The hides and skins are obtained from animals.
3. The pelts are divided into four classes.
4. Skins are obtained from small animals.
5. Kips are the skins of large animals.
6. The pelts of animals come to the tanner in three conditions.
7. The hide of the horse serves as the leather for shoes.

4. Fill in the words from the list, then make sentences using the completed phrases.

Moist; process; heavy; belting; book; pelt; curing.

1 ……. operation
2 machinery …….
3 leather…….
4 tanning…….
5 ……. …. binding
6 green…….
7 …… condition

1) **Match the synonyms.**
2) receive
3) pelts
4) be damaged
5) wet
6) fresh pelt

a) coverings
b) moist
c) obtain
d) green
e) putrefy

5. Write a summary of the text.

6. Retell the text.

7. Listen and watch the video. Are the sentences true or false?

1. The hides from large animals and skins from small animals come from one part of the world.
2. The hides from large animals and skins from small animals are a by-product of the meat industry.
3. Hides arrive at the tannery after treating with acid.
4. Salt preserves hide from bacterial action.
5. Shaking out the salt is the final process.
6. Avoiding pollution of the water system is taken into account.

Unit 20

Morphology of the skin

Morphology or structure of the skin has been studied for many years under the microscope. This wonderful instrument has revealed many secrets of cell formation and has aided in the explanation of certain known results.

The skin of the animal serves not only as covering but as an organ of feeling and secretion and has a complicated structure.

The skin of animal used for fur purposes, like the skin of all animals, consists of two parts – the epidermis and the dermis. The epidermis is the upper layer or top skin. It is entirely removed before tanning.

The lower skin or dermis is known technically as the corium. The surface of the corium has a very fine, compact, fibrous structure and forms what is known as the grain of leather. The corium consists of many interwoven fibers known as “connective tissue». These fibers are made up of numerous thin, fine threads or fibrils which are held together in a compact mass by a gelatin-like substance called collagen.

The skin is united to the animal by a network of connective tissue which is frequently full of fat cells – “adipose tissue” known as “flesh». It is removed from corium prior to tanning by the operation known as “fleshing”. Ordinarily, the corium or true skin is the only portion used for leather.

1. Words and word-combinations to be remembered.

to reveal - відкривати
covering - покрив
to remove - видаляти
connective tissue - сполучна тканина
fibrous - волокнистий
substance - речовина
cell - клітина
flesh - міздря

2. Answer the questions.

1. What does the skin of the animal serve for?
2. What is the structure of the skin?
3. How can you define the epidermis and the corium?
4. What does the corium consist of?
5. What are the corium fibers made of?
6. What is collagen?
7. What is the skin united to the animal?

3. State True or False (T/F).

1. The skin of the animal serves only as covering.
2. The skin of animals consists of two parts.
3. The lower skin known technically as corium.
4. The surface of the corium has a very fine, compact, plain structure.
5. Epidermis isn't entirely removed before tanning.
6. The lower skin is full of muscles.

4. Fill in the blanks.

The skin of the animal consists of two principal _____, the epidermis and corium.

Epidermis is entirely _____ before tanning; it must be done without _____ the skin itself.

The lower skin or dermis consists of many interwoven fibers known as _____, which is frequently full of _____ adipose tissue.

5. Match the synonyms.

1) interwoven fiber
2) fat cell
3) epidermis
4) thread
5) dermis
6) corium

a) fibril
b) upper layer
c) corium
d) adipose tissue
e) connective tissue
f) lower layer

5. Write a summary of the text.

6. Retell the text.

7. Complete the gaps in the sentences with the words from the video.

The structure of the skin

Subcutaneous outer epidermis connective extracellular inner

1. The skin is connective tissue that consists of cells, fibers and ……. matrix.
2. The epidermis is the thin …… layer of skin.
3. The dermis is the thicker ……. layer of skin.
4. Beneath the dermis lies a loose ……. tissue, called subcutaneous tissue or hypordermis.
5. Deeper tissues including muscle, tendon, ligament, joint capsule, and bone lie beneath the ……tissue layer.
6. The dermal-epidermal junction or basement membrane zone separates the ……. from the dermis.

Unit 21

Preparation for tanning

The processes of changing the skin of animal into leather consist of three stages: preparation for tanning; tanning; finishing.

Hides and skins are brought to the tannery as usual in a cured condition. Curing may be done in salting. Salt checks the bacterial action which would otherwise cause irreparable damage. When skins are thoroughly cured, they are usually free from bacterial action. But it mustn't be supposed that the concentrated salt solution stops the activity of all kinds of bacteria. Salt has a tendency to draw water from the skin. It was found necessary to add sodium chlorine to the salt to prevent stains.

At the tannery skins are properly washed and cleaned. This cleaning is done in large washing machines. Water used for washing should range between 50 and 68. It should be free of organic matter and iron salts that might stain the hides.

To remove flesh and fat from the skins tanners use a fleshing machine. Next operation is soaking which must be carried out with great care.

The skins are soaked in a lime solution to loosen the hair so that it can be easily removed by the machine. This process is called unhairing or depilation. When the preliminary treatment is provided the skins are ready for a conventional tanning process.

1. Words and word-combinations to be remembered.

tannery - шкіряний завод
a cured condition - консервований стан
irreparable - непоправний
thoroughly - ретельно
to prevent - запобігати, попереджати
lime – вапно

2. Answer the questions.

1. What three stages of changing the skin of animal into leather do you know?
2. Does the concentrated salt solution stop the activity of all kinds of bacteria?
3. What water is used for washing hides and skins?
4. What does a fleshing machine do?
5. What is depilation?
6. When are the skins ready for tanning?

3. State True or False(T/F).

1. The processes of changing the skin of animal into leather consist of four main stages.
2. Hides and skins are brought to the tannery in a cured condition.
3. When skins are thoroughly cured, they aren't usually free from bacterial action.
4. Water has a tendency to draw salt from the skin.
5. At the tannery skins are properly washed and cleaned.
6. To remove flesh and fat from the skins tanners use a knife.
7. The skins are soaked in a lime solution.

4. Fill in the blanks.

All the hides must be properly _____ before tanning. A fleshing machine removes _____ and ____. After fleshing the hides are soaked in a lime _____. Curing may be done by _____. Skins are washed and cleaned in large ____ ____. When skins are thoroughly cured, they are free from ____ ____.

(fat, salting, washing, bacterial, machine, cured, action, flesh, solution)

5. Match the synonyms.

1) curing
2) depilation
3) to occur
4) thoroughly
5) tannery
6) stain
7) to prevent

a) plant
b) mortar
c) spot
d) to warn
e) salting
f) loosening the hair
g) to happen

6. Write a summary of the text.

7. Retell the text.

8. Arrange these sentences according to the order you watch/ hear in the video.

1. **Deliming** is done to neutralize alkalis
2. In **pickling** weak acid and salt solution is used.
3. The hides are **soaked** in water to remove salt dirt and give moisture to hides.
4. **Fleshing** is done to remove fleshing tissues from the flesh side of the skin.
5. **Bating** is done to make leather flat, relaxed, clean and ready for the next step.
6. **Liming** is done next and leather is soaked in alkaline silution to remove hair, proteins, greases from hide.

Unit 22

Drying

Drying can be achieved either by hanging the tanned leather for a few hours in the appropriate tunnels, or through vacuum driers, or by drying with toggling systems, or other dry methods, according to the type of product and of the finishing type of leather that must be obtained.

Air drying involves hanging the hides on hooks so that moisture can evaporate naturally, this is the slowest process and results in shrinkage of the hide. Bad for yield, but great for giving leather a "full" or "round" hand. An air dried hide will routinely shrink by 25%. This also yields an article that is pliable with a bit of stretch.

Vacuum drying, which is probably the most complex option, is basically the same as pasting. The main difference is that we can drop the pressure inside the (massive) machine and draw the water out. This is the most time effective of the processes, and requires skill and diligence to do correctly.

Vacuum drying is a process that consists in positioning the entire hides/skins or half hides out of metal plates, hermetically closed by a cover. The drying is achieved by a combined action of heat and pressure reduction between the floors of work, which allows to obtain the fast evaporation of water at lower temperatures. The drying conditions are adjustable according to the characteristics of the product to be processed through the control systems on board.

Considerable reductions in energy consumption can be achieved by optimising the mechanical dewatering processes prior to drying.

Temperature and humidity during the drying need to be carefully controlled. Keeping drying temperature low and drying time and amount of exhaust air at the necessary minimum will keep heat losses to a minimum (although, consideration of leather properties will have priority).

Toggling frame dryers, the leathers are under tension drawn and suspended by means of special toggle clips that lock in a frame without piercing the leathers. In some cases, dryers, used for the purpose, are made up of frames that run on chain conveyors from inside to outside of the drying chamber, and each frame supports a perforated sheet metal that can be folded in order to toggle the leathers on both sides of the frame; in other cases, the frames are automatically pulled

through a rail system, or they or are constructed in the manner of a continuous metal conveyor. The expansion systems can be automatic or manual, and the toggling systems also can be manual or automatic.

1. Match the terms to their definitions

1. shaving
2. splitting
3. setting out
4. sammying machine
5. wet toggling
6. hang drying
7. vacuum drying

a) a multi-purpose operation, which smoothes and stretches the hides, while compressing and squeezing out excess moisture.

b) keeping the hides in a stretched position and letting them dry on perforated frames by means of clips called toggles.

c) smoothing the hides onto a heated stainless steel plate, then covering by a perforated steel plate which is covered by a felt. (a kind of wool cloth)

d) drapping the hide over a horizontal shaft and letting it dry as you would do with clothes on a line.

e) cutting through skins / hides or leathers at a set thickness.

f) an apparatus that absorbs the grease and water from the hide during the wet process in tanneries

g) removal of material from the rear surface of the flat semi-finished leather product in order to produce a homogeneous thickness

2. Watch the video "Drying leather" and complete the words.

smoothes and stretches / tumbled leather / squeezing out

horizontal shaft / perforated steel plate

The hides are approaching the time when they must be dried out. Setting out process puts them into the proper condition for drying. It is a multi-purpose operation, which 1 ..... the hides, while compressing and 2 ..... excess moisture. The type of machine used is very similar to the shaving machine except that the blades on the cylinder are shaped so as not to produce any cutting action.

Wet toggling is one of the drying methods that is used to create soft 3 ..... Hides are kept in a stretched position on perforated frames by means of clips called toggles.

Vaccuum drying is used to create smooth tight leathers. In the vaccuum dryer, the wet hides are smoothed onto a heated stainless steel plate, then covered by a 4 ..... which is covered by a felt or cloth. A vaccuum is pulled which extracts water vapor from leather.

Hang drying is the simplest method of drying. It is performed by drapping the hide over a 5 ..... and letting it dry as you would do with clothes on a line. After the drying processes, the leather must be conditioned and mechanically softened before it is processed further.

Unit 23

Mechanical Finishing Processes and surface coat applications

A wide range of mechanical finishing operations may be performed to improve the appearance and the feel of the leather. The following list of operations includes commonly used mechanical finishing operations, although the list is not exhaustive and many other operations exist for special leathers:

· Conditioning (optimizing the moisture content in leathers for subsequent operations);
· Staking (softening and stretching the leather);
· Buffing / dedusting (abrading the leather surface and removing the resulting dust from the leather surface);
· Dry milling (mechanical softening);
· Polishing;
· Plating / embossing (flattening or printing a pattern into the leather).

These operations may be conducted before, after, or in-between the application of coatings.

Conditioning

In this step, conditioners are applied to the leather. This helps them retain some helpful moisture and oils that will keep the leather flexible, and supple over time.

The leather must be reconditioned to ideal characteristics in terms of humidity. This can mean either increasing or reducing the humidity. In order to create the correct conditions one uses the conditioning machine. Modern

conditioning machines create an airflow in which water is vaporised both from the grain side and the flesh side of the leather in order to obtain the correct humidity throughout the whole section of the leathers. Simpler systems spray vaporised water on the grain side.

Staking

Staking is a mechanical method that increases the pliability and softness of the leather.

This helps turn leather into a smoother, more supple material that is preferred for leather goods and accessories. This is a mechanical operation where the hides are put through a machine on a conveyor belt equipped with a pin wheel that stretches the fibers in every direction, thus separating the fibers and softening the leather.

Softening and spreading of leather are the main aim of the staking process and also contribute effectively its yield. The head type vibration staking machines concept are based on pin design for wet or dry hides processing; the mechanical and electric device provide the synchronised oscillation motion

Staking can also be performed manually, in low volume or individual tanner productions, though is very time and labor intensive.

Buffing

In order to create a more visually appealing grain side of the hide, as well as make it smoother to the touch, it is buffed. Buffing if performed with a sanding drum. This step leaves the grain side smooth, though also produces a lot of leather dust from the sanding.

Different surface abrasion techniques can also be used to apply a finish to the leather. These can include buffing with special paper to help create nubuck/suede finish, or wheels with various materials on them to provide a sheen or shine to the surface of the leather.

Polishing

A leather polish is disclosed which not only polishes but cleans and preserves the leather. In addition, the polish makes the leather soft and supple while imparting water resistance. The polish is in the form of an emulsion which consists essentially of water, a solvent, a wax, an emulsifier and the reaction product of particular hydroxyl endblocked siloxanes and amino-functional silanes.

Surface Pressing / Embossing

This is where leather can really take on a different look and feel. During surface pressing, large machinery that utilizes rollers or presses can imprint a pattern into the leather. This creates a textured or patterned appearance on the surface.

1. Come up with the best-fitting definitions to these words.

1. Staking
2. Embossing
3. Conditioning
4. Finishing
5. Nubuck
6. buffing operation
7. sanding process

a) top grain leather whose surface has been buffed and brushed to create a soft, suede like look and feel. It is much stronger and durable than suede but does not have the wear and stain resistance common to other top grain leathers.

b) the process that involves applying an abrasive paper on a rotating roller to the surface (grain side) or reverse (flesh side). This results in a uniform surface.

c) the process used to create a "gloss" type leather or to remove light defects and to provide a smooth surface and look.

d) the process that determines the appearance of the final surface of the leather and the surface properties. This includes colouring, waterproofing, wax dressings, but also mechanical processing stages such as ironing or embossing of the leather.

e) the process that implies optimizing the moisture content in leathers for subsequent operations.

f) the process of softening and stretching the leather.

g) stamping leather using heat and high pressure to create a pattern or design in the hide.

2. Decide on the correct option.

1. Modern conditioning machines create an airflow in which water is vaporised both from the grain side and the flesh side of the leather in order to obtain the correct **softness / humidity**.
2. **Embossing / Buffing** includes using special paper to help create nubuck/suede finish.
3. Softening and spreading of leather are the **primary / secondary** aim of the staking process and also contribute effectively its yield, processes and surface coat applications.
4. **After / prior** to embossing, leather may be bonded with foam and lining on the back so that the embossed pattern sits neatly and retains its depth.
5. During surface **pressing / staking**, large machinery that utilizes rollers or presses can imprint a pattern into the leather.
6. Different surface **moisturing / abrasion** techniques can also be used to apply a finish to the leather.
7. Staking helps turn leather into a **less / more** supple material that is preferred for leather goods and accessories.

8. The higher the **softness / pressure**, the stronger and more durable the embossing.
9. Different surface abrasion techniques can include buffing with special paper to help create nubuck, suede finish, or wheels with various materials on them to provide a **sheen / dullness** to the surface of the leather.

3. Match the synonyms to the following words.

1. feel	a) wet, moist
2. flex	b) improve, enhance
3. supple	c) gloss, lustre
4. pliable	d) store, keep
5. emboss	e) see-through, crystal clear
6. damp	f) perception, touch
7. refine on	g) bend, fold
8. transparent	h) decorate, print
9. retain	i) flexible, bendable
10. sheen	j) elastic, soft

4. Complete the text with the words provided.

abrasion test crack inspection color computer UV stability physical testing

Once the leather is finished, it goes through [1]..... to make sure industry standards are met. The flexometer makes sure the finish does not [2].....
The well rubbing test is to make sure there will be no color transfer.
Next is the [2]..... wich is done if the leather is intended for automotive use.
Lastly the leather color is tested both visually under the light box and by a [3] .....
All leathers are a nlso checked for [4] ..... Once the leather passes all testing, the final step is ironing, measuring and one last is [5].....

6. Watch or listen to the next part of the video and correct 4 mistaken words. Replace the mistaken words with the ones from the sentences.

1.After the drying processes the leather must be pliable and mechanically softened before it is processed further.
2.Conditioning is the first step in adjusting the final temper.
3.The leather is then staked to make it conditioned. Softness can be controlled by adjusting the pressure and speed setting on the machine.
4. The buffing operation can be used to create a "smooth" type leather or to remove light defects.
5. Light sanding leaves a clean, nubuck surface ready for the subsequent finishing operation.

5. Watch or listen to the next part of the video. Spot and correct 4 mistaken words

1. After the drying processes the leather must be degreased and mechanically softened before it is processed further.
2. Conditioning is the first step in adjusting the final temper.
3. The leather is then staked to make it rigid. Softness can be controlled by adjusting the pressure and speed setting on the machine.
4. The buffing operation can be used to create a “gloss” type leather or to remove light defects. Light sanding leaves a clean, rough surface ready for the subsequent finishing operation.

Unit 24

Peculiarities of processing equipment for leather and fur production

Mechanical operations and processes of leather and fur production are associated with the action of the main working elements of machines, aggregates and mechanical devices of apparatuses on the dermis and hair.

By the nature of the impact of working elements on the semi-finished product and hair, mechanical operations can be divided into five groups:

1. Operations involving the removal of individual components of the skin or partial removal of the dermis to get the leather with a given thickness and properties (mechanical dehairing, felting, doubling, planing, grinding, pruning);
2. Operations associated with the deformation of the skin tissue of the semi-finished product (mechanical cleaning of the grain, pressing of moisture, wiring, mechanical bating, pulling, breaking, pressing);
3. Physical and mechanical effect on the semi-finished product during drying and moistening;
4. Pre-treatment and finishing of the hair covering (chopping, cutting, epilating, carding, punching, dusting);
5. Operations connected with processing of the leather grain (coating dyeing, polishing, lustering).

Design and operation of process equipment are impossible without knowing the specific features of leather and fur production.

Security precautions when operating processing equipment

As a rule, all machines and apparatuses from machine-building enterprises

that come to leather and fur factories with dangerous detail components and mechanisms are fenced. In this case, the task of the enterprise workers is to constantly maintain the fence. Apparatuses of leather and fur production are assembled on-the-spot. Therefore, the safety fences and devices for individual and group installation of the machines are made at the enterprise. For the successful fulfillment of the security precautions and the minimization of injuries in the production, special attention should be paid to the proper placement of equipment in the workshops of the enterprise.

General security precautions when operating machines and apparatuses

1. All machines, vehicles, units, devices and means of transport in dangerous places must be securely fenced. The dangerous places include all open, moving drive components of machines and apparatuses, moving parts of detail components and mechanisms (all kinds of gears, shaft ends, flywheels, etc.). The fence must be firmly attached to the elements of the equipment or the design of the premises (floors, walls, ceilings, etc.).
2. Electric motors and starting equipment of machines, especially in "wet" workshops, should be reliably grounded.
3. Instructions as for working arrangements on technological equipment and safety instructions when operating on this machine or apparatus should be hung at workplaces next to the machines and apparatuses.
4. All equipment must be kept in good condition; the information concerning work prohibition on this equipment should be posted on it.
5. Only workers who know the design of the machine and safe working methods are allowed to work on these machines and apparatuses.
6. Machines and apparatuses should be located in the workshops in such a way that their installation, maintenance and repair are convenient and safe.
7. Safety devices (bars, curtains, grates, etc.) must be sure to work. It is prohibited to operate on machines with faulty safety devices.
8. The workplace should be free of foreign objects. Generated waste when accumulated should be removed from the working place.
9. The equipment must be provided with care and systematic maintenance.

1. Come up with proper definitions to these terms.

1. mechanical operations
2. processing equipment
3. safety precautions
4. batch processing
5. technological process
6. one-piece flow
7. apparatus

a) the process involves moving one work unit at a time between each step of the process - with no breaks in time. It saves time, energy, and costs.
b) the process involves the processing of bulk material in groups through each step of the process; used during processing of raw materials or semi-finished products in working solutions carried out by production lots.
c) a group or combination of instruments, machinery, tools, materials, etc., having a particular function or intended for a specific use. d) the operations performed by a machine or machinery.
e) a set of procedures where one or several products are produced from certain starting materials.
f) preventative measures that are taken in order to ensure that something is safe and not dangerous.
g) the machinery, apparatus and utensils used in manufacturing or processing and packaging.

2.Match the synonyms to the words

1. preparatory	a) workshop, department, shop
2. assemble	b) fixation, fastening
3. on-the-spot	c) frame, barrier
4. fence	d) at the place, at the time
5. treatment	e) exposed to, go through
6. batch	f) gradually, in series
7. latching	g) collect, bring together
8. room	h) processing
9. in succession	i) set, bunch
10. subjected to	j) preliminary, introductory

3. Decide on the correct option.
1. Compared with batch processing, the duration of which is expressed **in days / in hours**, one-piece flow treatments are short-lived and are performed within seconds or minutes.
2. Special attention should be paid to the proper placement of equipment in the **backyard / workshops** of the enterprise.
3. Only workers who know the brand / design of the machine and safe working methods are allowed to work on these machines and apparatuses.
4. The equipment must be provided with care and **systematic / infrequent** maintenance.
5. Instructions as for working arrangements on technological equipment and safety instructions when operating on this machine or apparatus should be hung at workplaces **next to / behind** the machines and apparatuses.

6. The principle scheme for fur production as a whole has much in common with the scheme of tanning, but there are some differences due to the fact that the **hair covering / flesh** remains in fur production.
7. During the tanning processes, the dermis structure is formed and **fixed / loose**, and during the finishing ones, the required consumer properties are given to the tanned semi-finished product.
8. **Preparatory processes / Finishing processes** and manufacturing processes are carried out in the raw-tanning shop.
9. **Dyeing / Liming** takes place on the spraying production area, and the finishing of the hair and skin tissue takes place on the finishing area.
10. The basis of leather and fur production consists of various technologies that are developed for each kind of leather or fur **collectively / separately.**

3. Come up with correct collocations

maintenance equipment treatments operations effects processes components process processing

1. mechanical .....
2. processing .....
3. safety .....
4. batch .....
5. technological .....
6. preparatory .....
7. detail .....
8. systematic .....
9. chemical and physico-chemical .....
10. successive .....

5.Watch the video "Occupational safety videos" and answer the following questions.

1. What are the common hazards related to leather industry?
2. What are the physical hazards related to leather industry?
3. What are the safety measures in splitting process?
4. What are the safety measures while mixing, storing and spillage of the chemicals.
5. What are the safety measures in squeezing process?
6. What are the safety measures in shaving operation?
7. What are the safety measures in re-tanning, dyeing and setting process?
8. What other hazards and safety measures can you mention?

Unit 25

Tanning

The series of processes by which the natural skins are converted into leather is broadly covered by the term “tanning”. The purpose of the tanning proper is to bring about changes of the skin properties preserving the hides from the putrefaction.

From the moment the hide is removed from the animal until it is completely tanned, it is constantly in danger of attack by bacteria that are a form of plant life. Bacteria react with the protein matter in the hide, breaking it down. The hide becomes foul-smelting and begins to rot. This is known as putrefaction. Through every stage in the tanning process, the tanner must constantly take precautions to keep his stock free of harmful bacterial action.

When skins and hides arrive at the tannery they are generally dry and stiff, so first they are put into water to soften them and get rid of any salt that has been put on to preserve them.

Next they are soaked in lime and water to loosen the hairs, so that they are easily removed, the flesh side of the skin is scraped to remove anything that is not really part of the skin and will not make leather. After being carefully washed in running water the skins are now ready for tanning.

Hides and skins tanned absorb certain properties of the agents with which they are tanned.

There are several methods of tanning, each producing a special type of leather with special characteristics: vegetable tanning, which produces firm leather with excellent abrasive resistance-sole leather, belting leather, strap leather, harness leather, luggage leather, and light leathers for fancy leather goods. Chrome tanning is used mainly for upper leather for shoes, for gloving, and for fancy leather goods where water resistance or softness is a desirable quality. Oil tanning is used principally in the manufacture of “chamois”. Alum tanning is used mainly for white leather. Combination tanning, which consists generally of vegetable tanning in combination with one of the mineral tannages, usually chrome, to combine in the finished leather some of the characteristics of both tannages, as in

upper side leather for shoes. Of these the two most important are vegetable tanning and chrome tanning.

1. Words and word-combinations to be remembered.
putrefaction - гниття
to rot - гнити
precaution - обережність, застереження
to get rid of - позбавлятися
fancy leather goods - галантерейні вироби
chamois - замша

2. Answer the questions.
1. What does the term tanning mean?
2. What is the main purpose of tanning?
3. What is putrefaction?
4. When are the skins ready for tanning?
5. What are the most important tanning methods?
6. What tanning method is mainly used for white leather?
7. What are the two most important methods?

3. State True or False (T/F).
1. Hides and skins having passed the preparation stage of tanning are leather.
2. The series of process by which the natural skins are converted into leather is known as tanning.
3. When skins and hides arrive at the tannery, they are wet.
4. Skins are soaked in lime and water to loosen the hair.
5. There are five methods of tanning.
6. Alum tanning is used mainly in the manufacture of chamois.
7. Chrome tanning is used for upper leather for shoes, gloving and fancy leather goods.

4. Complete the table.

Methods of tanning

Vegetable	Chrome	Alum	Oil	Combination

(sole leather, belting leather, harness leather, luggage, fancy leather goods, upper leather for shoes, gloving, chamois, strap leather)

5. Fill in the blanks.

The purpose of the tanning proper is to bring about changes of the skin properties preserving the hides from_____. From the moment the hide is removed from the animal until it is completely tanned, it is in danger of attack by _____. Hides and skins soon _____ if they are not given preserving treatment. The tanner must constantly take _____ to keep his stock free of _____ bacterial action. Hides and skins are soaked in ____ and _____, so that they are easily removed.

6. Write a summary of the text.

7. Retell the text.

8. Watch the video and pick up the option that really matches the context of the sentences.

1. Tanning turns the hide into wet **blue / leather**.
2. The **least / most** common type of tannind is a chrome tanning.
3. A **light / heavy** metal chromium is used in the form of chromium sulfate in which hides are dipped.
4. Tanning makes leather stable and it will **obviusly / never** rot or putrefy.
5. During crusting process, shaving is done using a machine with **helical / perforated** blades.
6. Then dying is done to give a **scarcity / variety** of colors to leather, meeting the leather requirements.
7. Lubrication with oil keeps the leathe **flexible / stiff** and soft.
8. Samming is done to **remove / add** water.
9. In drumming a stacking machine massages leather to **compress / separate** fibres and make it soft.
10. In buffing and brushing, through **manual / mechanical** rubbing the flesh side is removed, then brushed to remove extra dust.

Unit 26

Finishing operations

On removal from the layer vats, the actual conversion of raw, hide substance into leather is complete. But at this stage the leather would be so crude and

unattractive. The finishing steps are numerous, and of great importance in transmuting a harsh stiff material into the beautiful finished leather.

To secure a uniform color penetration in a subsequent operation, the leather is bleached. This done by dipping the stock for a short period first in a weak alkali solution then in a weak acid solution after which the stock is washed and put through a wringer.

The stock is still harsh and stiff; under flexing, the leather would crack. It is placed into a large heated drum. When this drum revolves, hot oils and greasers are introduced. This lubricates the fibers and imparts flexibility. It is called stuffing.

To impart a suitable color, the leather must be stained or dyed. Dyeing is done in a rotating drum by putting the coloring matter in solution.

To separate the fibres sticking together, and to make the leather flexible and supple, it is staked. This operation is done on a staking machine.

Then the leather is placed in a heated drum with an emulsion of soaps and oils to lubricate the fibres and prevent cracking of the grain surface.

The leather is sammied by dipping into warm water and then piling it in damp sawdust until it absorbs a considerable amount of moisture.

These final operations are numerous and depend on the type of finished leather required.

1. Words and word-combinations to be remembered.

penetration - проникнення
to bleach - відбілювати
alkali - луг
to crack - тріщати
flexibility - гнучкість
grease - жир, змазка
to lubricate – змазувати

2. Answer the questions.

1. What finishing operations do you know?
2. How is bleaching done?
3. What lubricants do you know?
4. Where is dyeing done?
5. What is a staking machine?
6. What is fat-liquoring?
7. How is the leather sammied?

3. State True or False (T/F).

1. Bleaching is done by dipping the stock for a long period in a strong alkali solution.
2. Dyeing is done in a large heated drum.

3. To impart a suitable color, the leather must be stained or dyed.
4. When a heated drum revolves, hot oils and greasers aren't introduced.
5. Staking is entirely done on a staking machine.
6. Finishing operations depend on the type of finished leather required.
7. An emulsion of soaps and oils lubricate the fibres and prevent cracking.

4. Fill in the blanks.

To secure a uniform color penetration, the leather is _____. The stock is still harsh and stiff; under _____, the leather would crack. As the drum revolves, hot _____ and _____ are introduced. Dyeing is done in a _____ drum. To separate the fibres sticking together, and to make the leather _____ and _____, it is staked. The finishing operations depend on the type of _____ required.

Match the synonyms.

1) dyeing
2) weak
3) oil
4) uniform
5) to lubricate
6) harsh
7) to rotate
8) thoroughly

a) to revolve
b) constant
c) to grease
d) tough
e) properly
f) greaser
g) coloring
h) strong

5. Write a summary of the text.

6. Retell the text.

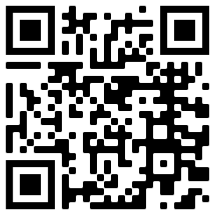
7. Watch the video and pick up the option that really matches the context of the sentences

1. Now the leather is ready for the **finishing / tanning** process.
2. The leather is placed on the conveyor **track / belt** and sent down the spray line.
3. The spray line consists of a **single / series** of computerised spray guns that apply the **finish / dye** on the surface of the leather hides.

4. Last is the final milling process, done to assure the **water resistance / softness** of the leather.

Освітня програма "Технічна електрохімія та елекрохімічна енергетика"

Unit 27



Electromotive force

When free electrons are dislodged from atoms, electrical energy is released and made available to do work. Chemical reaction, friction, heat and electromagnetic induction will cause electrons to move from one atom to another. Whenever energy in any form is released, a force is developed. Electrical energy being released, and a force called electromotive force (e.m.f.) is developed.

If the force exerts its effort always in one direction, it is called direct; the force changing its direction of exertion periodically is referred to as alternating. The chemical reaction in a dry cell produces a negative charge or potential on the zinc. This charge being always negative, the e.m.f. is unidirectional (one way). Heat and friction, too, are sources of a unidirectional force. Electromagnetic induction, however, is certain to produce an alternating force.

In the battery, the determining factors are kinds of electrolytes and the kind of the metals to be used for the plates. The common dry cell is found to develop 1.5 volts of electrical force regardless of the size of the cell. Large amounts of force can be obtained only by putting many cells in series.

The force developed by the generator depends on the number of coils in the armature, on the speed of the armature, on the strength of the magnetic field from the field magnets. The volt is known to be the unit of measure for electrical force.

Whenever an e.m.f. is developed, there is also a field of energy called an electrostatic field. This field can be detected by an electroscope, the strength measured by an electrometer.

1. **Words and word-combinations to be remembered.**

to dislodge - зміщувати
to release - звільняти, випускати
friction - тертя

electromotive force - електрорушійна сила
exertion - зусилля, напруга
alternating - змінний
charge - заряд
cell - комірка
to obtain - отримувати

2. **Answer the questions.**

1. When is electrical energy released?
2. What causes electrons to move from one atom to another?
3. What is an electromotive force?
4. What types of electromotive force do you know?
5. What does the force developed by the generator depend on?
6. What is the unit of measuring for electrical force?
7. What is an electrostatic force?

3. **State True or False (T/F).**

1. Chemical reaction, friction, heat and electromagnetic induction cause electrons to move.
2. The ampere is the unit of measuring for electrical force.
3. The chemical reaction in a dry cell produces a positive charge.
4. Whenever energy in any form is released, a force is developed.
5. Large amounts of force can be obtained only by putting one cell.
6. An electrostatic field can be detected by an electroscope.
7. The force depends on the number of coils, on the speed of the armature.
8. Electromagnetic induction produces an alternating force.

4. **Match the synonyms.**

1) to cause
2) force
3) to obtain
4) dimension
5) to name
6) matter
7) movement
8) velocity

a) measurement
b) substance
c) speed
d) strength
e) to induce

f) receive
g) motion
h) to call

Fill in the words from the list.

(heat, circuit, generator, force, conductivity, volts, resistance)

1. We know the ampere to represent the rate of electricity flow through the _____.
2. Electric pressure or e.m.f., which is measured in _____, causes electricity to flow.
3. The passage of current through a conductor of wire causes _____ to be generated in it.
4. Pure annealed copper is said to have 100 per cent _____.
5. Copper and silver electrodes are certain to give a higher _____ gap than such metals as zinc, magnesium and so on.
6. A _____ appears to be a device by which mechanical energy is transformed into electrical energy.
7. The only _____ which can make an electron move is that due to the fields of other electrons.

5. ***Write a summary of the text.***

6. ***Retell the text.***

7. ***Watch the video "*****How Electromotive Force Works*****" and answer the questions***
   1. What does electromotive force (EMF) refer to?
   2. What are the components of a simple circuit?
   3. What is the role of an inductor?
   4. What is called an electromagnetic induction?
   5. What is the influence of back EMF?

Unit 28

The electric current and its types

In a metal there is a large number of electrons, which are free and can move through the metal under the action of an electric force. When such an electric force is applied to the metal, these electrons move from one part of metal to another. 5)And this is called an electric current. A difference of electrical pressure or potential is necessary to maintain a flow of electrons in a conductor. The movement of electrons through conductors occurs very easily and very small electric pressures are sufficient to make electrons move. The practical unit of current is called the ampere. It is defined from the amount of metal deposited by a current from the amount of metal deposited by a current from electrolytic solution in a given time. To measure the resistance of a conductor, we should have some fixed standard. The practical unit of resistance is called the ohm. It can be defined from the relation between the difference of potential and the current that flows in conductor. There are different types of electric current: direct, alternating and oscillating. A direct current flows through a conducting circuit in the same direction, although it may vary in magnitude. It may be obtained from a storage battery.

An alternating current varies its direction periodically. This current flows first in one direction and then in the other one and the time of each variation is constant. An oscillating current varies periodically at frequency determined by the circuit constant such as inductance, capacitance and resistance.

1. Words and word-combinations to be remembered.

electric force – електрична сила
to apply – застосовувати
to mode – рухати (ся)
conductor – провідник
electric current – електричний струм
flow – потік; протікати
pressure – тиск
to maintain – підтримувати
resistance – опір
application – застосування

circuit – коло
direct current – постійний струм
alternating current – змінний струм
oscillating current – індуктивний струм
axis – вісь
half cycle – напівперіод
inductance – індукція
capacitance – ємнісний опір

2. Answer the following questions.

1. What is there in a metal?
2. How can electrons move through the metal?
3. When do electrons move from one part of the metal to another one?
4. When is there a current in the conductor?
5. What is a current?
How can we maintain a flow of electrons in a conductor?
7. What is the practical unit of current?
8. What types of electric current do you know?
9. What is the practical unit of resistance?
10. What is an alternating current?

3. State true or false (T/F).

1. When an electric force is applied to the metal, electrons can't move from one part of metal to another.
2. There are four different types of electric current.
3. A complete set of positive and negative half cycles is called a cycle.
4. A difference of potential is necessary to maintain a flow of electrons in a conductor.
5. The practical unit of current is called the ohm.
6. The movement of electrons through a conductor is lazy.
7. A direct current flow through a conducting circuit in the same direction.
8. The practical application of electricity doesn't depend on the effects produced by the electric current.
9. An alternating current flows in one direction.
10. An oscillating current can vary.

4. Fill in the words from the list, then make sentences using the completed phrases.

Magnetic, battery, driving, current, copper, half, circuit, chemical, motion, practical.

1 ……action

2 complete……
3 ……affect
4 ……. wire
5 molecular…….
6 ……. cycle
7 electric…….
8 ……. …. force
9 primary…….
10 ……application

5. Match the terms with their definitions.

1) ammeter
2) energy
3) electric current
4) ampere
5) direct

a) a type of current which flows in the same direction
b) practical unit of current
c) apparatus used to measure the electric current
d) ability to do the work
e) the flow of electrons through a conductor

6. Write a summary of the text.

7. Retell the text.

8. Watch the video and answer the questions

1. What is an electric current?
2. How had scientists been able to generate static charge before the 19th century?
3. What did scientist Allessandro Volta invent?
4. How does a battery work?
5. What is the contribution of B. Franklin into the invention of electric current?
6. What is resistance?
7. Explain the Ohm's Law
8. What can you say about ohmic materials?
9. How can we make the resistance of conductive materials extremely low?
10. Give the definition of the concept "power".

Unit 29

Electrochemistry

Electrochemistry deals with the relations between the transformations of chemical and electrical energy. We know it to owe its birth to the discoveries of Volta. It culminated in the invention of the voltaic pile at the end of the eighteenth century. This tool was employed by Humphrey Davy to study the chemical action of electric currents and to isolate potassium and sodium from the molten hydroxides of these elements. But Davy's most significant service to science was his finding and training Michael Faraday to whom more than anyone else electrochemistry is indebted. Not only the discovery and enunciation of the two laws upon which so much of electrochemistry is practically based are due to this experimental genius but also the principle of electromagnetic induction, which led ultimately to an economical means of generating energy, essential for the industrial application of electrochemistry

Davy had liberated a number of new metals by passing electric current through molten compounds of those metals. Faraday named this process electrolysis and a compound or solution that carry an electric current an electrolyte, in 1832 Faraday further reduced the matter of electrolysis to quantitative terms by announcing what are now called Faraday's laws of electrolysis.

Electrochemistry is a component part of physical chemistry and plays an important role today in many areas of science and technology.

The subject of electrochemistry is concerned with charge transfer at the boundary between an electronically conducting or semi conducting phase and an ionic conducting phase, such as liquid, molten or solid electrolyte.

1. Words and word-combinations to be remembered.

electrochemistry – електрохімія
discovery – відкриття
invention – винахід
molten – рідкий
law – закон
application – застосування
carry out – виконувати
compound – сполука
solution – розчин

reduce – скорочувати
charge transfer – переміщення заряду
solid – тверда речовина
liquid – рідина
potassium – калій
sodium – натрій

2. Answer the questions.

1. What does electrochemistry deal with?
2. What discoveries gave birth to electrochemistry?
3. What is the voltaic pile?
4. Why did Humphrey Davy use the voltaic pile?
5. Wham is electrochemistry indebted?
6. What can illustrate Faraday's experimental genius?
7. What is electrolysis?
8. What is the role of electrochemistry in modern life?
9. What chemistry is electrochemistry a component part?
10. What has the subject electrochemistry included?

3. State True or False (T/F).

1. Electrochemistry is a part of organic chemistry.
2. The invention of the voltaic pile was in the seventeenth century.
3. Davy studied chemical action of electric currents and isolated potassium and sodium from the molten hydroxides of these elements.
4. Davy found and trained Michael Faraday.
5. Principle of electromagnetic induction lad to an economical means of generating energy.
6. Faraday's laws put electrochemistry on its modern basis.
7. Electrolyte is a compound which can't carry an electric current.
8. The numerous electro analytical processes aren't in wide use now.
9. The subject of electrochemistry is concerned with charge transfer.
10. Faraday's discoveries are of great importance.

4. Fill in the words from the list then make sentences using the completed phrases.

Pole, molten, industry, electromagnetic, application, electric, chemistry, measuring, transfer, basis

1 charge……..…
2 electrochemical….
3 ……..…hydroxide
4 voltaic……
5 ……induction

6 ……..…basic
7 physical…….
8 ……..…. current

5. Match the synonyms.

1) application
2) carry out
3) substance
4) transformation
5) significant
6) liberate
7) happen
8) discovery
9) essential
10) train

a) teach
b) use
c) substantial
d) fulfill
e) matter
f) opening
g) important
h) change
i) free
j) occur

5. Write a summary of the text.

6. Retell the text.

7. Complete the following statements with words from the video:

1. The first battery was invented by Alessandro Volta in ….
2. The chemistry occurring in a voltaic cell is just a spontaneous …. reaction which we know as a … of electrons.
3. Electrons captured in oxidation then flow from the anode to the … which generates a current of … energy, which can be harvested to do work.
4. Each side of the cell is called a … cell.
5. There is also something called a … from which ions flow to maintain …balance.
6. Ions in the salt bridge compensate for the …change in overall ….

7. In an … cell an electric current drives an otherwise …reaction.
8. Just as water flows from …pressure from to low pressure, electrons flow from … of high to low electrical ….
9. Fluorine has a very high electron ….
10. To calculate …for any hypothetical voltaic cell, … just calculate Ecathode …Eanode.

Unit 30

Semiconductors and their application

All substances have some ability to conduct electric current, but they differ in the ease of conductivity. Metals such as copper, gold, silver or iron are excellent conductors, but materials such as glass, porcelain, rubber are considered as insulators. Intermediate between the two groups are semiconductor materials. They include all minerals, many chemical elements, a great variety of chemical compounds, allays.

The conductivity of silicon, germanium, phosphorus, baron increases with heating and falls with cooling.

A great experimental work had to be carried out before scientists were able to explain the phenomenon of semi conductivity. It was only after the quantum theory in the form of wave mechanics was applied to the motion of electron in crystalline solids that a satisfactory theory of semi conductivity emerged.

The high conductivity of good conductor is due to a great number of relatively free electrons in the metallic crystal. They provide a great number of charge carriers to give high currents under low voltage. The low conductivity of the insulators is due to the lack of available free electrons.

In semiconductors electrons are bound, but the connection is so weak that the heat motion of the atoms of a substance pulls them away and sets them free. Wherever an electron has left its normal position in the interatomic bond, there is an electron vacancy or hole in the crystal framework, which is a positive charge carrier. Thus when an electron is released from a band by thermal energy there is created an electron-hole pair, making possible intrinsic conduction by both positive and negative carriers.

A semiconductor in which the conduction is due to holes is said to be of p-type (positive charge), and there is n-type (negative charge).
Semiconductors are widely used in modern electronic techniques (rectifiers, transistors, thermopiles), in measuring technique computers, radio and TV sets for transmission of signals, for automation and remote control of a variety processes, for switching on engines, for production of sound, protection of high-voltage transmission lines and so on.

1. Words and word-combinations to be remembered.

to conduct – проводити
conductor – провідник
conductivity – провідність
semiconductor – напівпровідник
insulator – ізолятор
alloy – сплав
property – властивість
to carry out – властивість
charge carrier – носій заряду
voltage – напруга
to reveal – відкривати
framework – решітка
intrinsic conduction – власна провідність

2. Answer the following questions.

1. What materials are good conductors?
2. What are insulators?
3. What materials belong to semiconductors?
4. What kind of electrical conductors are defined as semiconductors?
5. What scientific theory gives an explanation of the semiconductor properties?
6. What semiconductors are called p-type and n-type?
7. What is the role of semiconductors in the development of science?
8. Where are semiconductors used?
9. What problems do semiconductors help to solve?
10. What do you know about application of semiconductors in modern life?

3. State True or False (T/F).

1. All substances have some ability to conduct electric current.
2. Copper, gold, iron and silver aren't conductors.
3. Glass, porcelain, rubber are insulators.
4. Semiconductors are all minerals, alloys of metals, a number of chemical and organic compounds.

5. Conductivity falls with heating and increases with cooling.
6. Electricity flows when electrons don't move.
7. There are three types of semiconductors.
8. Semiconductors are widely used in modern electronic techniques.
9. Semiconductors convert direct current into alternating current and electric energy into heat energy.
10. Semiconductors help to convert thermal and solar energy into electric power, and electric energy into mechanical energy.

4. Fill in the words from the list, then make sentences using the completed phrases.

Quantum, framework, thermal, vacancy, solids, semiconductor, experimental, charge, element, free.

1 ……. …. work
2 ……. vibration
3 crystal …….
4 ……..... material
5 electron …….
6 ……...theory
7 crystalline…….
8 carrier……
9 chemical……. …..
10……...electron

5. Match the terms with their definitions.

1. a semiconductor in which the conduction is due to holes and the carriers act like positive charges;	a) an electric current
2. glass, porcelain, rubber are excellent;	b) conductors
3. movement of electrons from to atom;	c) insulators
4. the quantum theory in the form of wave mechanics was applied to the motion of electron in crystalline solids;	d) a p-type semiconductor
5. copper, gold, silver, iron are good;	e) theory of semi conductivity

6. Write a summary of the text.

7. Retell the text.

8. Watch the video and compete the gaps.

1. The metal is an electric …and glass is an insulator.
2. The silicon is ….at room temperature but conducts electricity when it is hot.
3. It is a semiconductor, whose conductivity changes based on the ….
4. Semiconductors have enabled electronics to become smaller, faster and more ….
5. Ina solid trillions and trillions of atoms … with each other.
6. For a material to conduct, the electrons must be able to jump from … energy states to … ones.
7. Metal s have no … at all.
8. Semiconductors have a medium- sized … gap.
9. Computers are made of semiconductors which are called ….
10. With semiconductors you can … add transistors to almost any device you can think of.

Unit 31

Galvanic cells

If a chemical reaction takes place at two separated electrodes, electrical power can be generated in an external conducting circuit connecting the two electrodes.

Galvanic cells are a means of converting chemical into electrical energy. Electrochemical current sources were first described as such in the work of Galvani, and shortly afterwards Volta constructed the first practical galvanic cell. Cells with larger current capacity were developed by Bunsen and Grove in the first half of the 19th century, and played an important role in early technical and scientific investigations of electricity.

Today galvanic cells are used in brood areas: in the supply of electrical power to cars, airplanes, space satellites, portable appliances, remote transmitters, automatic weather stations, flight control equipment. Conventional batteries, such

as the lead accumulator, the alkaline – manganese, zinc – mercury and silver – zinc systems remain of great technical importance.

A galvanic cell consists of two electrodes, the electrolyte, battery housing and the electrode separators. There are two broad categories of battery: a secondary battery – if the electrochemical reactions can be reversed and the battery thereby recharged; a primary cell – if one or both of the electrode reactions is irreversible.

A galvanic cell which produces power as long as the electrochemical reactants are provided to the cell and the products removed is called a fuel cell. That's why a fuel cell has the advantage over a battery: a sufficient supply of fuel, electrical power can be produced continually and indefinitely.

1. Words and word-combinations to be remembered.

cell – комірка, елемент, датчик
circuit – коло
convert – перетворювати
investigation – дослідження
provide – забезпечувати
primary battery – первинна батарея
secondary battery – вторинна батарея
reactant – реагент
fuel cell – паливна елемент
supply – постачання
reversible - зворотній

2. Answer the following questions.

1. What are galvanic cells?
2. When were the first galvanic cells constructed?
3. What is the role of galvanic cells in modern science?
4. Where are galvanic cells used?
5. What cells are of great technical importance?
6. What does a galvanic cell consist of?
7. What categories of batteries do you know?
8. What is a primary cell?
9. What is a secondary cell?
10. What is a fuel cell?

3. State True or False (T/F).

1. If a chemical reaction takes place at two connected electrodes, electrical power can be generated in an external circuit separating the two electrodes.
2. Galvanic cell is a means of converting chemical into electrical energy.

3. The first galvanic cells were constructed in the twentieth century.
4. Galvanic cells are used in the supply of electrical power to cars, airplanes, space satellites etc.
5. Conventional Batteries, such as the lead accumulator, the alkaline – manganese, zinc – mercury and silver – zinc systems are of great importance.
6. The first cells were constructed by Faraday.
7. A Galvanic cell consists of two electrodes and the electrolyte.
8. If a Battery can recharge it is called secondary.
9. A fuel cell has the advantage over a Battery.
10. Galvanic cells are widely used in modern life.

4. Fill in the words from the list, then make sentences using the completed phrases.

Electrical, electrodes, scientific, appliances, lead, component, external, battery, fuel, reactants.

1 ……. cell
2 ……. accumulator
3 separated…….
4 electrochemical…….
5 ……. …. power
6 portable……
7 active……
8 primary……
9 ……investigations
10……polarity

5. Match the antonyms.

1) connect
2) external
3) modern
4) construct
5) important
6) failure
7) broad
8) reversible
9) improve
10) advantage

a) irreversible
b) narrow
c) make worse

d) separate
e) internal
f) destroy
g) unimportant
h) disadvantage
i) success
j) out of date

6. Write a summary of the text.

7. Retell the text.

8. Watch the video and try to explain the principles of working of a useful galvanic cell

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Contents

Навчальний посібник «English for Chemists» призначений для студентів факультету хімічних та біофармацевтичних технологій, які вивчають дисципліну «Іноземна мова фахового спрямування». Посібник складається з двох частин. Перша частина вміщує 13 розділів, які мають оригінальні тексти відповідної тематики загального курсу хімії, завдання для аналізу цих текстів та вправи для закріплення професійно-орієнтованого матеріалу. Друга частина посібника має розділи, кожний з яких вміщує тексти та завдання відповідно до освітніх програм: технологія та експертиза шкіри і хутра, технічна електрохімія та електрохімічна енергетика, хімічні технології волокон, хімічні технології переробки полімерних композиційних матеріалів і промислова фармація.

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АНГЛІЙСЬКА ДЛЯ ХІМІКІВ

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