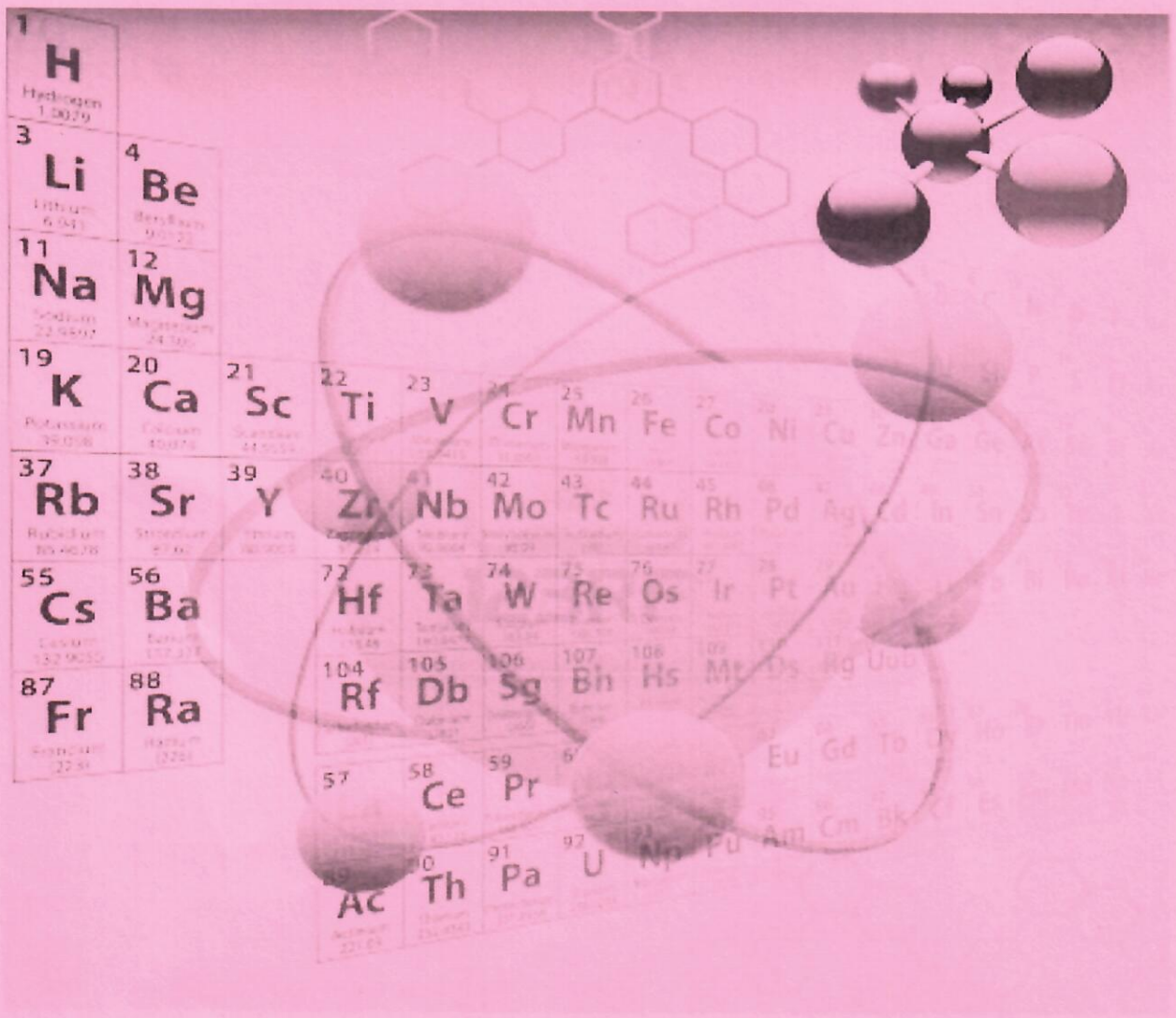
The World of Chemistry

АНГЛІЙСЬКА МОВА ЗА ПРОФЕСІЙНИМ СПРЯМУВАННЯМ ДЛЯ СТУДЕНТІВ ПРИРОДНИЧИХ СПЕЦІАЛЬНОСТЕЙ



Навчальний посібник

НАЦІОНАЛЬНИЙ ПЕДАГОГІЧНИЙ УНІВЕРСИТЕТ ІМЕНІ М. П. ДРАГОМАНОВА

КАФЕДРА ІНОЗЕМНИХ МОВ
ІНСТИТУТУ ПРИРОДНИЧО-ГЕОГРАФІЧНОЇ ОСВІТИ ТА ЕКОЛОГІЇ

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Рецензенти:

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Навчальний посібник "Хімія" призначений для вивчення англійської мови за професійним спрямуванням студентами І та ІІ курсів природничих спеціальностей.

Завдання розроблені з урахуванням комунікативних потреб майбутніх спеціалістів з хімії.

Посібник забезпечує формування мовленнєвої компетенції, допомагає засвоїти фахову термінологію, активізувати вміння практично застосовувати набуті знання.

Посібник рекомендовано до вивчення як в аудиторії, так і самостійно.

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ПЕРЕДМОВА

Методичні рекомендації для роботи над текстами за фахом " Хімія" призначені для вивчення англійської мови студентами I та II курсів природничих спеціальностей.

Методична розробка складена згідно з вимогами навчальної програми з іноземних мов для підготовки бакалаврів з хімії і охоплює базовий лексичний мінімум.

Мета даної розробки – розвиток навичок розуміння й аналізу наукових текстів з основних проблем хімії, уміння вести бесіду, брати участь у дискусіях англійською мовою, формувати соціально-комунікативну позицію фахівця в галузі природничих наук.

Збірник складається з 10 розділів, кожний з яких містить окрему проблему – тему і включає автентичні тексти із зарубіжної наукової літератури. До текстів пропонуються лексичні вправи та завдання на розвиток мовленнєвих вмінь та навичок у ситуаціях реального спілкування. Це вправи на тлумачення окремих фахових термінів, на переклад з рідної мови на англійську і навпаки. В кінці кожної теми пропонуються різні творчі завдання, спрямовані на закріплення вивченого матеріалу.

Рекомендується для опрацювання студентами як в аудиторії, так і самостійно.

CONTENTS

UNIT 1

TEXT A. MY STUDIES AT THE UNIVERSITY

Education today is more important than at any previous time in our history. It helps young people to meet challenges of life and to see the world with greater understanding. This course is for large number of students of natural sciences to whom English will be a vital part of their scientific life. English is the language of international scientific communication all over the world.

The goal of education is to help each student to get as much knowledge as possible, to become a creative thinker, to develop a good self-image when he takes his place in the working world. Studies should help students to discover that dealing with scientific issues is fun, interesting and important to their lives.

The objective of a study programme is to provide good knowledge in science and in a special field of student's interest. Students learn to carry out and interpret investigations, and acquire teaching and technical skills in sciences.

The Institute develops a curriculum that produces a well-rounded student with good training in a chosen area of research.

For chemists the programme involves the study of all traditional fields of chemistry: inorganic, analytical, crystal, colloidal, organic, physical, polymer, as well as chemical engineering, mathematics, physics and humanities. Geography department trains geologists, mineralogists, volcanologists, seismologists, geochemists and many other specialists. Students of biology can major in botany, zoology, physiology, genetics, virology, microbiology, molecular biology, biotechnology and many other extremely interesting and important fields.

At higher schools basic material is presented in the form of lectures supplemented by class discussions, seminars and laboratory exercises. Students work in laboratories to learn various experimental techniques and to become familiarised with instrumentation and other faculty facilities.

Besides studies and research work students can take part in numerous social activities offered by their department or university. They attend interesting meetings, lectures, films, exhibitions, join various sports and art clubs or societies.

The department actively helps its students to find their professional positions, placing them in jobs for which they are well prepared and in which they can prosper. Graduates of the departments of natural sciences can take industrial posts or choose academic career both in teaching and research fields.

Exercise 1. Learn by heart the following definitions.

Education - the process of developing knowledge or skills; teaching.
Knowledge - range of information or understanding; what is known.
Curriculum - a course of study in a school or college.
Student - one who studies something; one who is enrolled for study at college, etc.
Graduate - one who has completed a course of study at a school or college.
Skill - ability or proficiency.
Technique - method of procedure, scientific operation.
Facility - means by which something can be easily done.
Department - faculty; a separate part or division.

Exercise 2. Answer the following questions to check your understanding of the text.

1. What is the role of education in the life of young people?
2. What is the goal of study programmes?
3. What fields of chemistry are studied at chemistry departments?
4. In what form is basic material presented?
5. Where do students become familiarised with experimental techniques?
6. What subjects are included in the curriculum?
7. What careers can graduates of the faculty choose?

Exercise 3. Translate into English.

Скористатися найкращим чином, відвідувати лекції, стати членом клубу або наукового гуртка, зайняти своє місце, проводити дослідження, мета навчання, галузь хімії, гуманітарні дисципліни, обрати кар'єру.

Exercise 4. Write down synonyms to the following terms.

Curriculum, investigation, technique, vital, exercise.

Exercise 5. Translate the proverbs and sayings. Explain their meaning in Ukrainian.

There are many English idioms that cannot be rendered into other languages. Quickly learnt, quickly forgotten. Learn like a parrot. To learn one's lesson. A little learning is a dangerous thing. To teach somebody a lesson. Teach a pig to play on a flute. Teach the dog to bark. Teach school. Learn wisdom by the follies of others. Learn to say before you sing. Learn to creep before you leap. Learn the ropes.

Exercise 6. Translate into English.

1.Роки навчання в університеті – це найкращі роки у житті молоді. 2. Метою навчальної програми на хімічному факультеті є надання глибоких знань у галузі загальної та спеціальної хімії. 3. Освіченій людині легше знайти своє місце у житті. 4. Крім теоретичних знань студенти набувають практичних навичок роботи в лабораторії. 5. Студенти також вивчають фізику, математику, іноземну мову, історію та інші гуманітарні науки. 6. Громадська активність – одна із важливих рис сучасних студентів. 7. Роки навчання найкращим чином готують молодь до кар'єри у промисловості, науці, освіті та мистецтві.

Exercise 7. Summarize the text (in written form).

TEXT B. THE WORLD OF SCIENCE

Science reflects the world in specific notions and concepts, elaborating its own language. This language is highly terminological and many scientific terms are of Greek and Latin origin, e.g. ***electrolysis, synthesis, analysis, solution, matter, substance, etc.***

The word «**chemistry**» is of seventeenth century English origin. The root ***chem*** probably refers to Khmi, the land in Egypt, where the technology of glass and metal was highly developed. Present-day chemistry is termed as the study of the composition of substances, and of their effect upon one another. Chemistry studies substances, their structure, properties, reactions and transformations. Although the study of matter is also the business of physics, geology, biology and ecology, all of them are in need of detailed understanding of how things and living organisms are made, that is why these sciences find their way into chemical laboratories.

Chemistry is a fundamental science giving origin to geochemistry, biochemistry, bio-organic and bio-inorganic chemistry, biophysics and chemical ecology.

Scientific languages have highly standard system of publications, among which there are monographs, articles, reviews, lectures, theses, abstracts, textbooks, etc. Not only the structure of such publications is unified, but also style of writing, which in fact is a combination of description, narration and reasoning. Scientific journals want their authors to document their articles according to scientific style and format. Scientific writing should be concise, not wordy, clear and informative.

Exercise 1. Answer the following questions.

1. What is the origin of the word «chemistry»?
2. What is the modern definition of this science?
3. Why do we call chemistry a fundamental science?
4. Of what origin are many scientific terms?
5. What terms does a scientist use in writing?
6. What types of scientific publications are there in scientific literature?
7. What scientific journals in the field of chemistry do you know and read?

Exercise 2. Write different types of questions to each sentence.

1. Present-day chemistry is termed as the study of the composition of substances, and of their effect upon one another.
2. Chemistry studies substances, their structure, properties, reactions and transformations.

3. Although the study of matter is also the business of physics, geology, biology and ecology, all of them are in need of detailed understanding of how things and living organisms are made, that is why these sciences find their way into chemical laboratories.

Exercise 3. Render the text (express in the Ukrainian language).

Scientific languages have highly standard system of publications, among which there are monographs, articles, reviews, lectures, theses, abstracts, textbooks, etc. Not only the structure of such publications is unified, but also style of writing, which in fact is a combination of description, narration and reasoning. Scientific journals want their authors to document their articles according to scientific style and format. Scientific writing should be concise, not wordy, clear and informative.

Exercise 4. Explain the meaning of the following terms in English.

Electrolysis, synthesis, analysis, solution, matter, substance, geochemistry, biochemistry, bioorganic, bio-inorganic chemistry, biophysics, chemical ecology.

Exercise 5. Match the synonyms.

Scientific, standard, system, publication, amidst, essay, manual, article, review, lecture, theme, analysis, lesson, thesis, abstract, summary, hand-book, structure, philosophical, criterion, organization, among, edition, arrangement.

Exercise 6. Summarize the text (in written form).

TEXT C. MY DEPARTMENT

I am a student of the Institute of Natural Sciences and Ecology. Our Institute is one of the largest at the University. There are many departments in our Institute: of chemistry, of botany, of zoology, of microbiology, of physiology of man, of physiology of plants and animals, of genetics, and of soil science. Besides there are research laboratories. Every student has an opportunity to work in modern well-equipped laboratories, where different problems of chemistry are under investigation.

I study at the department of chemistry. We study different subjects: Chemistry, Physics, Mineralogy, Biology, Geography, Microbiology and many others. Besides these subjects we study some Social Sciences, History, Ukrainian and English. We study English to be able to read scientific books and discuss problems of chemistry.

Chemistry is a branch of science that deals with how substances are made up, how they (their elements) combine, how they act under different conditions. Chemists study substances, their properties and transformations. Students of chemistry study matter. They will learn all about elements, compounds and mixtures. In their experiments students will combine elements to form compounds. For example, they will use hydrogen and oxygen and will obtain water.

Students often use scientific instruments in their experimental work. Students get acquainted with all branches of chemistry. They are lectured in various subjects of natural science, namely botany, zoology, anatomy, microbiology, biophysics, biochemistry, genetics and soil science.

During the first two years of study they attend lectures on chemistry, physics and some subjects of Natural Sciences and foreign languages. In the third year more narrow specialization begins. They have several specialized courses and additional practical and research work in the subject they have chosen as their future speciality.

Besides attending lectures they may join some scientific circles and choose a problem to work on according to their bents. All of them know that chemistry is the science of glorious past and great future. They do their best to acquire as much knowledge as possible.

Graduates of the department of chemistry are assigned to work at laboratories, schools and research institutes. Those who have a bent for research work may apply for a post-graduate course of study.

Exercise 1. Entitle each paragraph of the text.

Exercise 2. Render the text (express in the Ukrainian language).

Chemistry is a branch of science that deals with how substances are made up, how they (their elements) combine, how they act under different conditions. Chemists study substances, their properties and transformations. Students of chemistry study matter. They will learn all about elements, compounds and mixtures. In their experiments students will combine elements to form compounds. For example, they will use hydrogen and oxygen and will obtain water. Students often use scientific instruments in their experimental work. Students get acquainted with all branches of chemistry. They are lectured in various subjects of natural science, namely botany, zoology, anatomy, microbiology, biophysics, biochemistry, genetics and soil science.

Exercise 3. Give definitions of the following terms in English.

Departments, Institute, chemistry, botany, zoology, microbiology, physiology of man, physiology of animals, physiology of plants, genetics, soil science, research laboratories.

Exercise 4. Write down synonyms of the following words.

Opportunity, investigation, subjects, to study, to attend, to get acquainted with, to deal with, bent, to acquire, to join, to apply for.

Exercise 5. Ask different types of questions to each sentence.

1.Chemists study substances, their properties and transformations. 2. Students of chemistry study matter. 3. They will learn all about elements, compounds and mixtures. 4. In their experiments students will combine elements to form compounds. 5. For example, they will use hydrogen and oxygen and will obtain water. 6. Students often use scientific instruments in their experimental work.

Exercise 6. Summarize the text (in written form).

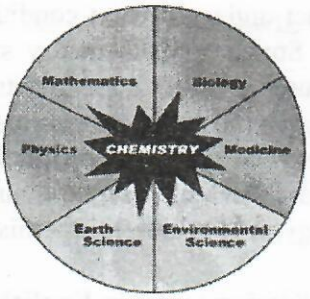
UNIT 2

Career Counselling & Training

TEXT A. WHY WE STUDY CHEMISTRY

Chemistry is an incredibly fascinating field of study. Because it is so fundamental to our world, chemistry plays a role in everyone's lives and touches almost every aspect of our existence in some way. Chemistry is essential for meeting our basic needs of food, clothing, shelter, health, energy, clean air, water and soil. Chemical technologies enrich our quality of life in numerous ways by providing new solutions to problems in health, materials and energy usage. Thus, studying chemistry is useful in preparing us for the real world.

Chemistry is often referred to as the central science because it joins together physics and mathematics, biology and medicine, the earth and environmental sciences. Knowledge of the nature of chemicals and chemical processes therefore provides insights into a variety of physical and biological phenomena. Knowing something about chemistry is worthwhile because it provides an excellent basis for understanding the physical universe we live in.



Chemistry:
The Central Science

Studying chemistry also puts one in an excellent position to choose from a wide variety of useful, interesting and rewarding careers. A person with a bachelor's level of education in chemistry is well prepared to assume professional positions in industry, education, or public service. A chemistry degree also serves as an excellent foundation for advanced study in a number of related areas. Even in times when unemployment rates are high, the chemist remains one of the most highly sought after and employed scientists.

EXERCISES AND ASSIGNMENTS

Exercise 1. Explain the meaning of the following word-combinations in English.

Field of study, touch every aspect, be essential for, enrich, provide solutions to problems, to join, insights into, a variety of phenomena, basis for, rewarding careers, to assume, foundation for, related areas, unemployment rates, seek after, advanced study.

Exercise 2. Render the text (in written form).

Chemistry is often referred to as the central science because it joins together physics and mathematics, biology and medicine, the earth and environmental sciences. Knowledge of the nature of chemicals and chemical processes therefore provides insights into a variety of physical

and biological phenomena. Knowing something about chemistry is worthwhile because it provides an excellent basis for understanding the physical universe we live in. Studying chemistry also puts one in an excellent position to choose from a wide variety of useful, interesting and rewarding careers. A person with a bachelor's level of education in chemistry is well prepared to assume professional positions in industry, education, or public service. A chemistry degree also serves as an excellent foundation for advanced study in a number of related areas. Even in times when unemployment rates are high, the chemist remains one of the most highly sought after and employed scientists.

Exercise 3. Ask different types of questions to each sentence.

1. Studying chemistry also puts one in an excellent position to choose from a wide variety of useful, interesting and rewarding careers. 2. A person with a bachelor's level of education in chemistry is well prepared to assume professional positions in industry, education, or public service.3. A chemistry degree also serves as an excellent foundation for advanced study in a number of related areas. 4. Even in times when unemployment rates are high, the chemist remains one of the most highly sought after and employed scientists.

Exercise 4. Give the initial form of the verbs.

Referred, sought, prepared, plays, serves, remains, provides, enrich, understanding.

Exercise 5. Find and present information about your career in chemistry.

Exercise 6. Write a short summary, using information from the text.

TEXT B. WHAT CHEMISTS DO

The behaviour of atoms, molecules, and ions determines the sort of world we live in, our shapes and sizes, and even how we feel on a given day. Chemists who understand these phenomena are very well-equipped to tackle problems faced by our modern society. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. To understand why an autumn leaf turns red, or why a diamond is hard, or why soap gets us clean, requires a basic understanding of chemistry. It may be obvious to you that a chemistry background is important if you plan to teach chemistry or to work in the chemical industry developing chemical commodities such as polymeric materials, pharmaceuticals, flavorings, dyestuffs, or fragrances. Chemists are frequently employed as environmental scientists, chemical oceanographers, chemical information specialists, chemical engineers, and chemical salespersons. A significant knowledge of chemistry is often required in a number of related professions including medicine, pharmacy, medical technology, nuclear medicine, molecular biology, biotechnology, pharmacology, toxicology, paper science, pharmaceutical science, hazardous waste management, art conservation, forensic science and patent law.

It is often observed that today's graduate, unlike the graduate of a generation ago, should anticipate not a single position with one employer or in one industry, but rather many careers.

You will be well prepared for this future if you take advantage of the opportunity to become broadly educated, to learn to be flexible and to be a creative problem solver. Knowledge and skills gained at the University may be directly applicable in your first job, but science and technology change at a rapid pace. You will keep up and stay ahead if you graduate with the skills and self-discipline to pursue a lifetime of learning. Since chemistry provides many of these

skills and is a fundamental driver in the business and commerce sector of our society, chemists and biochemists are likely to remain in continual demand. A chemistry background will be helpful in the advanced study of biochemistry, endocrinology, physiology, microbiology, and pharmacology. Chemistry is also an excellent major for students planning careers in other health professions such as pharmacy, dentistry, optometry and veterinary medicine. All of these professions require knowledge of chemistry. Most require knowledge of general and organic chemistry, both with laboratories. Many students have found that having a chemical background gives them a distinct advantage in these professional fields.

Chemistry isn't for everyone; but those students who choose chemistry usually find it interesting as it is challenging, and they always take great pride in the degree they earn as undergraduates.

EXERCISES AND ASSIGNMENTS

Exercise 1. Read the text. Determine the main problem.

Exercise 2. Ask 10 questions to the text (in written form).

Exercise 3. Fill in the gaps with the suitable words.

You will be well … for this … if you take … of the opportunity to become broadly educated, to … to be flexible and to be a creative … solver. Knowledge and skills … at the University may be directly … in your first job, but science and technology change at … pace. You will … up and stay ahead if you … with the skills and self-discipline … a lifetime of learning. Since … provides many of these skills and is a fundamental … in the business and commerce sector of our society, chemists and … are likely to remain in continual … . A chemistry …. will be helpful in the … study of biochemistry, endocrinology, physiology, microbiology, and … . Chemistry is also an excellent … for students planning careers in other health … such as pharmacy, dentistry, optometry and … medicine.

Exercise 4. Translate the terms.

Medicine, pharmacy, medical technology, nuclear medicine, molecular biology, biotechnology, pharmacology, toxicology, paper science, pharmaceutical science, hazardous waste management, art conservation, forensic science, patent law.

Exercise 5. Render the text (in written form).

The behaviour of atoms, molecules, and ions determines the sort of world we live in, our shapes and sizes, and even how we feel on a given day. Chemists who understand these phenomena are very well-equipped to tackle problems faced by our modern society. To design a synthetic fiber, a life-saving drug, or a space capsule requires knowledge of chemistry. To understand why an autumn leaf turns red, or why a diamond is hard, or why soap gets us clean, requires a basic understanding of chemistry. It may be obvious to you that a chemistry background is important if you plan to teach chemistry or to work in the chemical industry developing chemical commodities such as polymeric materials, pharmaceuticals, flavorings, dyestuffs, or fragrances. Chemists are frequently employed as environmental scientists, chemical oceanographers, chemical information specialists, chemical engineers, and chemical salespersons.

Exercise 6. Entitle each paragraph of the text.

Exercise 7. Explain the meaning of the following terms in English.

Synthetic fiber, a life-saving drug, a capsule, background in chemistry, to teach chemistry, the chemical industry, to develop chemical commodities, polymeric materials, pharmaceuticals, flavourings, dyestuffs, fragrances, environmental scientists, chemical oceanographers, chemical information specialists, chemical engineers, chemical salespersons.

Exercise 8. Write a short summary, using information from the text.

TEXT C. TYPES OF CHEMISTRY. CAREERS IN CHEMISTRY

Fundamentally, chemistry is the study of matter and change. Traditionally, chemistry has been broken into five main subdisciplines: **Organic**, **Analytical**, **Physical**, **Inorganic and Biochemistry**.

Organic chemistry is a sub-field of chemistry that involves studying the molecules of life. It is mainly concerned with looking at the structure and behavior of these molecules, which are composed of only a few different types of atoms: carbon, hydrogen, oxygen, nitrogen, and a few miscellaneous others. These are the atoms used to construct the molecules that all plants and animals require for their survival. The kinds of molecules organic chemists synthesize include useful things like drugs, flavorings, fragrances, plastics (polymers), and agricultural chemicals (fertilizers and pesticides). Organic chemistry is essential for learning biochemistry and molecular biology because bio-molecules such as proteins, sugars, fats, and nucleic acids are all organic molecules. Students who concentrate in organic chemistry typically go on to work in pharmaceutical, food or polymer companies, do research or teach in organic chemistry, pursue medical careers.

Analytical chemistry is the science of identification and quantification of materials in a mixture. Analytical chemists may invent procedures for analysis, or they may use or modify existing ones. They also supervise, perform, and interpret the analysis. Students concentrating in analytical chemistry often go on to work in forensics laboratories, environmental or pharmaceutical companies, work in, pursue research, or teach in colleges and universities.

Physical chemistry is the study of the fundamental physical principles that govern the way that atoms, molecules, and other chemical systems behave. Physical chemists study such topics as the rates of reactions (kinetics), the way that light and matter interact (spectroscopy), how electrons are arranged in atoms and molecules (quantum mechanics), and the stabilities and reactivities of different compounds and processes (thermodynamics). Students who concentrate in physical chemistry may go on to pursue careers in industry, research or teaching. Others apply physical techniques to the study of biological systems (why do proteins fold into the shapes that they have, how is structure related to function, what makes a nerve work, etc.) - this type of study is biophysical chemistry. Still others may use physical techniques to characterize polymers or study environmental systems.

Inorganic chemistry is commonly thought of as those areas within chemistry that do not deal with carbon. However, carbon is very important in many inorganic compounds, and there is a whole area of study known as organometallic chemistry. Some areas of inorganic chemistry are catalysis, materials chemistry, and bioinorganic chemistry. Catalysts are chemical entities that

increase the rate of a reaction without being consumed. Many of the chemists who would be identified as inorganic or organometallic chemists work in this area. Materials Chemistry is an area concerned with the design and synthesis of materials that allow the advance of technologies in nearly every area of society. Bioinorganic chemists study the function of metal-containing compounds within living organisms. Students who concentrate in inorganic chemistry often go on to work in industry, in polymer or materials science, do research or teach in inorganic chemistry.

Biochemistry is the study of the chemical principles underlying basic biological systems. Fundamentally, biochemical research aims to characterize the link between the structure and function of biological macromolecules. More specifically, biochemical research has provided a more comprehensive understanding in regenerative medicine, infectious disease, organ/tissue transplantation, clinical diagnostics and genetic disease. Students who concentrate in biochemistry go on to pursue extremely successful careers in medicine, research, and business.

EXERCISES AND ASSIGNMENTS

Exercise 1. Read the text. Determine the main problem.

Exercise 2. Fill in the gaps with the suitable words.

… chemists study such topics as the … of reactions (…) , the way that light and matter interact (…) , how electrons are arranged in … and molecules (quantum mechanics), and the stabilities and reactivities of different … and processes (thermodynamics). Students who concentrate in … chemistry may go on to pursue … in industry, research or teaching. Others apply … techniques to the study of … systems (why do … fold into the shapes that they have, how is structure related to … , what makes a nerve work, etc.) – this type of study is … chemistry. Still others may use physical … to characterize polymers or study … systems.

Exercise 3. Define the parts of speech. Translate them.

Analytical, chemistry, the, science, of, and, quantification, materials, in, a, mixture, chemists, may, invent, procedures, for, analysis, or, they, use, modify, existing, ones, they, also, supervise, perform,interpret, concentrating, often, go, on, to, work, forensics, laboratory, environmental, pharmaceutical, companies, work in, manage, design, quality, assurance, procedures, pursue, research, teach, colleges, university.

***Pattern*:** never – adverb (прислівник), ніколи

Exercise 4. Form and write down derivatives of the following words.

Molecule, biology, bio-, protein, sugar, fat, nucleus, proton, acid, organ, study, who, concentrate, type, chemist,work, pharmacy, poly-, company, do, search, teach, medicine career.

Exercise 5. Render the text.

Some areas of inorganic chemistry are catalysis, materials chemistry, and bioinorganic chemistry. Catalysts are chemical entities that increase the rate of a reaction without being consumed. Many of the chemists who would be identified as inorganic or organometallic chemists work in this area. Materials Chemistry is an area concerned with the design and synthesis of materials that allow the advance of technologies in nearly every area of society. Bioinorganic chemists study the function of metal-containing compounds within living

organisms. Students who concentrate in inorganic chemistry often go on to work in industry, in polymer or materials science, do research or teach in inorganic chemistry.

Exercise 6. Say if the statements are true or false. Correct them.

Organic chemistry is commonly thought of as those areas within chemistry that deal with carbon. However, carbon is very important in a few organic compounds, and there is a whole area of study known as inorganic chemistry. Some areas of inorganic chemistry are catalysis, materials chemistry, and physical chemistry. Catalysts are biological entities that decrease the rate of a reaction without being consumed. Many of the chemists who would be identified as inorganic or organic chemists work in this area. Biochemistry is an area concerned with the design and synthesis of materials that allow the advance of technologies in nearly every area of society. Organic chemistry is essential for learning biochemistry and molecular biology because bio-molecules such as protons, sugars, fats, and nucleic acids are all organic molecules. Students who concentrate in organic chemistry typically go on to work in forensics laboratories, environmental or pharmaceutical companies, work in, manage and/or design quality assurance procedures, pursue research, or teach in colleges and universities.

Exercise 7. Ask 10 questions to the text (in written form).

Exercise 8. Give the main ideas of the text in your summaries.

UNIT 3

Exercise 1. Define the parts of speech. Translate them.

Chemist, chemistry, chemical, simpler, older, substance, united, proportion, tasteless, greenish, approximately, ordinary, temperature, odourless, moderately, pressure, greater, conversely, property, broadly, reaction, catalyst, decomposition, addition, quantity, suitable, readily, exception.

Exercise 2. Read and translate the words.

a) Formed, attended, considered, classified, finished, worked, played, lived, indicated, needed, waited.
b) Element, properties, property, quite, decompose, substance, hydrogen, oxygen, proportion, approximately, ordinary, liquid, layer, moderately, appears, greenish-blue, one hundred degrees Centigrade, millimetres pressure, viewed, conversely, crystalline, vapour, hoar frost, main, headings, undergoes, decomposition, catalyst, compound, evolution, attended, quantity, equation, steam, alkali, sodium, potassium, et cetera, non-metals, exceptions, silicon, fluorine, chlorine.

Exercise 3. Give the initial form of the verb.

Considered, were, known, is, appears, freezes, attended, will decompose, indicated.

Exercise 4. Translate the terms without a dictionary.

Chemist, chemical, element, proportion, temperature, millimetre, metal, catalyst, potassium, carbon, silicon, fluorine, chlorine, oxygen, hydrogen, crystalline, sodium, reaction, act, action.

TEXT A. PROPERTIES OF WATER

The older chemists considered water to be an element. They were quite right because they did not know how to decompose it into simpler substances. It is known that water consists of hydrogen and oxygen only, united in the proportions of two to one by volume approximately.

At ordinary temperatures pure water is a tasteless andodourless liquid; it is colorless in moderately thin layers, but appears greenish-blue when viewed in thick layers. Water boils at 100° C under 760 mm pressure. The greater is the pressure, the higher is the boiling point; and conversely, the less is the pressure, the lower is the boiling point. Liquid water freezes at 0° C into crystalline ice. Water vapour freezes into hoar frost and snow.

The chemical properties of water can be classified broadly under three main headings, viz.:

1) reactions in which water undergoes decomposition;
2) reactions in which water acts as a catalyst;
3) reactions in which water forms addition compounds.

The combination of hydrogen and oxygen to form water is attended by evolution of a large quantity of heat as indicated in the equation $2H_2 + O_2 = 2H_2O + 116.2$ Cals, the water formed remains as steam.

Many elements will decompose water at a suitable temperature. The alkali metals (sodium, potassium, etc.) attack water readily at the ordinary temperature. Non-metals for the most part do not react with water, the exceptions being carbon and silicon, fluorine and chlorine.

Words:

100° C – one hundred degrees Centigrade
The ..., the … – чим, … тим
Viz. (namely) – а саме

EXERCISES AND ASSIGNMENTS

Exercise 1. Read the text.

Exercise 2. Fill in the gaps.

1. The older chemists didn't know how to decompose water …simpler substances.
2. Water consists … hydrogen and oxygen united in the proportion of 2:1 … volume approximately.
3. Water boils … 100° C … mm pressure.
4. Pure water is colourless … thin layers.
5. Liquid water freezes … 0° C … crystalline ice.
6. Non-metals do not react … water.
7. Many elements will decompose water … suitable temperature.

Exercise 3. Give the English equivalents.

Бути правим, більш прості речовини, складатись із водню та кисню, при звичайній температурі, рідина без смаку, при температурі 100°С, підлягати розпаду, діяти як каталізатор, утворювати додаткові сполуки, при відповідній температурі, лужні метали, неметали, супроводжуватися виділенням, легко розкладати воду.

Exercise 4. Fill in the gaps with the suitable words.

1. Water consists of ..... and ..... .
2. Pure water is a ..... and ..... liquid.
3. Water is ..... in thin layers and appears ..... in thick layers.
4. Water ..... at 100° C and ..... at 0° C.
5. Water acts as a ..... .
6. Water ..... decomposition.
7. Alkali metals attack water at a ..... temperature.
8. Many elements decompose water at a ..... temperature.

(decompose, attack, undergo, hydrogen, suitable, colourless, oxygen, ordinary, boil, odourless, freeze, addition).

Exercise 5. Make up sentences.

1) hydrogen, of, water, consists, oxygen, and.
2) ordinary, water, tasteless, at, odourless, is, pure, liquid, and, temperature, the.
3) water, non-metals, do, react, not, with.
4) ordinary, water, the alkali, the, attack, readily, at, metals, temperature.
5) vapour, water, into, freezes, and, snow, hoar frost.

Exercise 6. Answer the questions.

1. What does water consist of?
2. What kind of liquid is water?
3. What temperature does it boil at?
4. What temperature does it freeze at?
5. What metals attack water at the ordinary temperature ?
6. Do non-metals react with water ?

Exercise 7. Agree or disagree using the phrases in the box below.

1. The older chemists considered water to be a compound.
2. Hydrogen and oxygen are united in the proportion of 1:2 by volume approximately.
3. At ordinary temperatures pure water is a tasteless and odourless liquid.
4. Water appears greyish-blue when viewed in thick layers.
5. The greater the pressure, the higher the boiling point.
6. The combination of hydrogen and oxygen to form water is not attended by the evolution of a large quantity of heat.
7. Sodium and potassium attack water readily at the ordinary temperature.
8. Most of non-metals react with water readily.

I think it's right.	As far as I know …
It seems to be wrong.	To my mind …
I can't agree with it…	On the contrary …

Exercise 8. Ask 10 questions to the text.

Exercise 9. Make a short report on the properties of water.

Physical properties: colour, odour, solubility, density, hardness, lustre, melting-point, boiling-point, freezing-point, size, weight.
Chemical properties: reactions with other materials when transformation of one substance into another takes place.

Exercise 10. Write a short summary of the text.

Exercise 11. Retell the text.

TEXT B. THE MOST IMPORTANT CHEMICAL SUBSTANCE

Water is hydrogen oxide, a compound of hydrogen and oxygen. It can be made if hydrogen or hydrogen containing substances are burnt in air or oxygen.

Most of the world's water is liquid but an important fraction is solid, as ice or snow. Many mineral substances contain water of crystallization (e.g. copper sulfate) and in the atmosphere there are millions of tons of water vapour. Clouds consist of minute droplets of water or crystals of ice. Water dissolves a very large number of substances and it is the most important solvent. It does not dissolve greasy, fatty substances or most plastics. It was established that ordinary water is impure, it contains dissolved salts and gases and sometimes organic matter. For chemical work water is to be purified by distillation. Pure water is colourless, tasteless, and odourless. Rain water is nearly pure water, containing only small proportions of dust and dissolved gases.

When the chemists had examined the properties of water, they found that physical properties of water could be used in many physical constants and units. The freezing point of water (saturated with air at 1 atm pressure) is taken as 0°C and the boiling point is of water at 1 atm is taken at 100° C. The unit of volume in metric system is chosen so that 1 ml of water at 3.98° C (the temperature of its maximum density) weighs 1.000 g/cm^3. So water is one of the most important of all chemical substances. It is a main constituent of living matter and of the environment in which we live.

Words:
droplet – краплинка
greasy – жирний, сальний
fatty – жирний
dust – пил
saturate – насичувати
define – визначати
environment – середовище, оточення

EXERCISES AND ASSIGNMENTS

Exercise 1. Answer the questions.

1. What is water?
2. How is water made in the lab?
3. Where can water be found in nature?
4. What is pure water?
5. What is rain water?
6. Where can the physical properties of water be used?

Exercise 2. Agree or disagree with the statements.

1. Water dissolves greasy, fatty substances and most plastics.
2. Ordinary water is not pure.
3. Water is the most important chemical substance.
4. Water is a hydrogen oxide.

Exercise 3. Find the following in the text and retell it.

1) про спосіб отримання води в лабораторії;
2) про розповсюдження води у природі;
3) про фізичні властивості води.

Exercise 4. What new facts about water did you learn about?

Exercise 5. Ask 4 types of questions to each sentence.

1. Pure water is colourless, tasteless, and odourless. 2. Rain water is nearly pure water, containing only small proportions of dust and dissolved gases. 3. Water is one of the most important of all chemical substances. 4. It is a main constituent of living matter and of the environment in which we live.

TEXT C. THE WATER PROBLEM

Water is the most common of all liquids and the most useful. Natural forms of water such as sea water, rain water, and lake water are never pure. Consumption of water increases annually, millions of tons are used each day in industry, so there exists a water problem.

The solution of this problem will be using sea water, because seas cover about 70 percent of the Earth's surface. Sea water varies in composition, it contains many solids dissolved in water. Sodium chloride, common salt, is the most abundant of the solids present. We can easily understand that distillation of sea water will give pure water and leave the solids in the distillation vessel which can be also used. The difficulty is to carry out this operation economically. To satisfy the great demands of industry, much fuel will be needed for making this distillation. However, using the Sun as the source of heat sea water has successfully been purified in some countries in recent years.

Words:
consumption – споживання
annually – щороку
vessel – посудина
to satisfy the demands – задовольняти вимоги
fuel – паливо
vary – змінюватися
very – дуже

EXERCISES AND ASSIGNMENTS

Exercise 1. Read the text.

Exercise 2. Write a report about the ways of purification of water

- **in Ukraine;**
- **abroad.**

Exercise 3. Translate into Ukrainian.

1. There are all kinds of various test tubes in the chemical laboratory.
2. There was some but not much water in the glass.
3. There will be still more new synthetic materials in future.
4. Is there any dust in pure hydrogen peroxide?
5. There exist more compounds of hydrogen than of any other element.
6. There were many interesting events at our University last year.
7. There were no mistakes at their works.
8. Are there English books at your library?
9. There are many interesting subjects at out curriculum.
10. There will be tests and examinations in winter.
11. There are several laboratory tables with chemical glassware at the laboratory of inorganic chemistry.
12. What glassware is on every laboratory bench?

Exercise 4. Make up sentences.

1) The, of, these, students, two, attend, the, departments, lectures, same.
2) Will, it, does, not, we, employ, method, what, our, in, work, matter.
3) Matter, varieties, is, of, the, branch, which, science, deals, with, different, or, substances, chemistry.
4) Are, the, reactions, chemical, that, processes, the, into, substance, substances, other.
5) A.Lavoisier, later, concept, the, introduced, the, of, elements, chemical.
6) Our, products, recently, produced, have, synthetic, product, many, new.
7) Your, in, chemistry, study, of, learn, will, you, things, many, substances, about, compounds, chemical (2), materials, and, physical, properties, changes, reactions, many, and interesting, other, things, important, and.
8) Russian, science, M. Lomonosov, devoted, to, his, life, development, the, of.

Exercise 5. Translate into Ukrainian.

Radio wave length, electricity generation methods, steel plate, oxidation states, hydrogen preparation method, thermonuclear fusion reaction, boiling-point determination, atmosphere pressure determination, rain water composition, hydrogen chloride dissolution, non-metal oxides, acid anhydrides application, alkali water solutions, glass production, metal surface treatment, computer simulation method, Solutions Chemistry Institute.

Exercise 6. Explain the meaning of the words in English.

Form (n.), to form (v.), change (n.), to change (v.), light (adj.), light (n).

Exercise 7. Translate into Ukrainian.

1. They found quartz in the form of large, nearly perfect crystals.
2. Quartz, silicates and aluminosilicates together with other minerals form a great amount

of ceramic raw materials.
3. Among ceramic products, alumina in both forms possesses the highest mechanical strength and hardness.
4. This is an example of chemical change, since a chemical change results in permanent changes of properties.
5. The properties of this substance change when we heat it.
6. He studies the change from one state to another.
7. The colour of the solution changed after the reaction.
8. The experimental temperature changed between room temperature and 1.4000°C.
9. Great changes took place at our laboratory.
10. Antimony does not react with nitric acid to form oxides.
11. The article dealt with the changes which took place during the reaction.
12. Ceramic products are light in weight.
13. The velocity of light is very high.
14. Aluminium is a very light metal.
15. Our laboratory is very big and light.

Exercise 8. Write a short summary of the text.

Exercise 9. Render the text.

THE ONSET OF COLOUR TELEVISION

In 1940, Peter Carl Coldmark, an engineer for Columbia Broadcasting System, demonstrated a colour television system that used a rotating three colour disk. Coldmark thus proved the practicability of colour television, although his system was later replaced by an all-electronic colour television was compatible with black-and white transmission.

In spite of all these successes, television did not come into its own as a medium until 1948. Since then, television has had a tremendous influence on industrialized societies. As a source news and entertainment, it is the centrepiece of the expanding market of consumer electronics.

Test yourself. Do you know the words?

Chemist, chemistry, to consider, water, element, to decompose, substance, to consist of, hydrogen, oxygen, to unite, pure, proportion, property, volume, ordinary, temperature, liquid, colour, colourless, thin, thick, layer, to boil, boiling-point, pressure, high, low, to freeze, to undergo, to act, to influence, compound, form, to form, change, to change, catalyst, to combine, combination, to attend, to evolve, evolution, quantity, steam, alkali metals, sodium, potassium, to attack, non-metals, to react, reaction, carbon, silicon, fluorine, chlorine, steam, vapour.

UNIT 4

Exercise 1. Define the parts of speech.

Remarkable, quantity, variety,reaction, electrolysis, sulfuric, density, exposure, combustion, detected, moisture, temperature, substance, oxidize, ordinarily, solution, mixer, mixture, convenient, easily, decompose, aqueous, treatment, presence.

Exercise 2. Read and translate the words.

a) formed, bubbled, evolved, oxidized, obtained, confined, decomposed, produced, symbolized, heated, impinged, floated, detected, produced, treated, prepared, exposed, passed, chilled, mixed.

b) hydrogen peroxide, compound, quantity, quantities, variety, electrode, electrolysis, dilute acid, anode, sulfuric acid, current, density, confined, quartz, vessel, exposure, mercury, combustion, for instance, impinge, surface, floating, either, sunlight, ozone, current, moist, through, issue, issuing gases, moisture, zinc, copper, lead, ordinarily, certain, barium peroxide, aqueous, hydrochloric, chloride, convenient.

Exercise 3. Give the initial form of the verbs.

Detected, is, impinges, shaken, symbolized, made, passes, obtained, exposed, decomposes.

Exercise 4. Translate without a dictionary.

Peroxide, reaction, reactive, reactivity, electrode, zinc, electrolysis, anode, ether, barium, detect, detective, detector, evolution, symbol, symbolize, aqueous, produce, production, ultra-violet.

TEXT A. HYDROGEN PEROXIDE

Hydrogen peroxide is a remarkable compound. It is formed in small quantities in a variety of reactions. For example, it is formed when oxygen is bubbled about the electrode from which hydrogen is being evolved during the electrolysis of dilute acid, and also at the anode during the electrolysis of dilute sulfuric acid by a current of high density. Water confined in a quartz vessel is decomposed by exposure to ultra-violet light rays from a mercury lamp, sunlight, etc., and hydrogen peroxide and hydrogen are formed.

$2H_2O = H_2O_2 + H_2$

Hydrogen peroxide is produced during the combustion of hydrogen in air. For instance, when a jet of burning hydrogen impinges on the surface of cold water, in which ice is floating, or on ice itself, hydrogen peroxide can be detected in the water; and is formed when moist ether is exposed to sunlight. Like ozone, hydrogen peroxide can be formed at a high temperature by passing a current of moist oxygen through a tube at about 2.000 and rapidly chilling the issuing gases. It is often formed when a substance is oxidized in the presence of moisture. For instance, when zinc, copper or lead is shaken up with air and dilute sulfuric acid the reaction symbolized:

$Zn + 2H_2O + O_2 = Zn(OH)_2 + H_2O_2$ and $Zn(OH)_2 + H_2SO_4 = Zn\ SO_4 + 2H_2O$

Hydrogen peroxide is ordinary made by the action of acids on certain peroxide, such as sodium peroxide or barium peroxide. By treating a cold aqueous solution of sodium peroxide with dilute and cold hydrochloric acid, a solution of hydrogen peroxide mixed with sodium chloride is obtained:

$2HCl + Na_2O_2 = 2NaCl + H_2O_2$

This is convenient on account of the ease with which hydrogen peroxide decomposes when heated.

EXERCISES AND ASSIGNMENTS

Exercise 1. Fill in the missing words.

1. Hydrogen peroxide is a … compound.
2. Hydrogen is evolved from … .

3. Hydrogen peroxide is produced during the … of hydrogen in air.
4. It is also formed by the … of acids on some peroxides.
5. We obtained a solution of hydrogen peroxide … with sodium chloride.
6. Hydrogen peroxide is decomposed when … .

Exercise 2. Find the following word-combinations in the text in English.

Перекис водню, невелика кількость, у процесі електролізу, розбавлена кислота, струм високої частоти, кварцова посудина, водень, що горить, холодна вода, висока температура, потік вологого кисню, у присутності вологи, розбавлена сірчана кислота, холодний водний розчин, хлористий натрій, при нагріванні, при обробці холодного водного розчину, це зручно внаслідок легкості, наприклад, гази, що виділяються.

Exercise 3. Compose the sentences.

1) Decomposed, water, by, exposure, is, rays, ultra-violet.
2) Burning, hydrogen, a jet, exposure, water, cold, of, the, surface, of, impinges, on.
3) Peroxide, in, hydrogen, detected, be, can, the, water.
4) Easily, decomposed, hydrogen, peroxide, is, when heated.
5) Compound, remarkable, a, hydrogen, is, peroxide.

Exercise 4. Agree or disagree with the statements using the cliché.

As far as I know …
It seems to be wrong (right) …
I can't agree with you …
I'm afraid you are mistaken …
On the contrary …
That's right …

1. Water confined in a quartz vessel is not decomposed by exposure to ultraviolet rays.
2. Hydrogen is produced during the combustion of hydrogen in air.
3. Hydrogen peroxide is not made by action of acids on certain peroxides.
4. H_2O_2 is obtained when a substance is oxidized in the absence of moisture.
5. H_2O_2 is formed when dry ether is exposed to sunlight.
6. Hydrogen peroxide is an ordinary chemical compound.

Exercise 5. Answer the questions.

1. Hydrogen peroxide is a remarkable compound, isn't it?
2. How is hydrogen peroxide formed?
3. Is hydrogen peroxide evolved during the electrolysis of dilute sulfuric acid?
4. What substance is produced during the combustion of hydrogen in air?
5. What other methods of obtaining hydrogen peroxide do you know?

Exercise 6. Complete the sentences.

Hydrogen peroxide is …
H_2O_2 is formed …
H_2O_2 is produced…
H_2O_2 is made…

Exercise 7. Copy out the sentences with the passive voice verb forms.

Exercise 8. Write down derivatives from the text.

To vary _____ To treat _____
To evolve _____ To act _____
To decompose _____ To moist _____
To expose _____ To bubble _____
To float _____ To light _____
To pass _____ To burn _____
To present _____ To remark _____

TEXT B. PROPERTIES OF HYDROGEN PEROXIDE

Hydrogen peroxide is a remarkable compound. It was discovered by L.Y. Thenard in 1818. It occurs in nature in rain, snow, dew, air. Pure hydrogen peroxide is a viscous liquid: it is colourless, when viewed in thin layers but appears bluish in thick layers. The liquid has no odour. Dilute aqueous solution has a peculiar metallic lustre. If concentrated sulfuric acid is mixed with hydrogen peroxide at low temperature, oxygen rich in ozone will be evolved. The liquid decomposes rapidly when heated at ordinary atmospheric pressure, but under reduced pressure it can readily distilled. It boils at 68-69° C under pressure of about 26 mm. The liquid crystallizes in needle-like prisms at –20° C. It is soluble in water in all proportions.

Pure hydrogen peroxide is fairly stable. Dilute aqueous solutions are kept well. A 3% solution showed no appreciable change when kept a year. Alkali solutions are not kept well. If alcohol or ether is added, the aqueous solutions will become more stable. Pure H_2O_2 is decomposed very rapidly if any dust is present. Like ozone hydrogen peroxide possesses strong oxidizing properties. It can act as an oxidizing as well as reducing agent.

Dilute aqueous solutions of hydrogen peroxide are used for bleaching (silk, feathers, straw, hair, ivory, teeth). It can be used in medicine as an antiseptic. Hydrogen peroxide is employed in analytical work for the oxidation of sulfites to sulfates, ferrous to ferric salts, nitrites to nitrates, etc.

Words:
dew – роса
needle – голка
silk – шовк
ivory – слонова кістка
feathers – пір'я
straw – солома

EXERCISES AND ASSIGNMENTS

Exercise 1.Answer the questions.

1. When was hydrogen peroxide discovered?
2. Where does it occur?
3. What liquid is pure hydrogen peroxide?
4. What is its boiling-point?
5. How stable is hydrogen peroxide?
6. What properties does hydrogen peroxide possess?

Exercise 2. Agree or disagree with the statements. Use the following phrases.

1. Hydrogen peroxide is not found in nature.
2. Pure hydrogen peroxide is a colourless and odourless solid.
3. The liquid decomposes slowly when heated.
4. It does not act as a reducing agent.

I think it's right.	As far as I know …
It seems to be wrong.	To my mind …
I can't agree with it.	On the contrary …

Exercise 3. Describe in details the properties of hydrogen peroxide.

Exercise 4. Entitle each passage of the text.

Exercise 5. Retell the text according the plan.

1) H_2O_2.
2) Discovery of H_2O_2.
3) Its occurrence.
4) Properties (physical and chemical).
5) Application (in industry; in laboratory; in medicine).

Exercise 6. Which new facts about hydrogen peroxide have you learned from texts A, B? Use the following phrases.

I think it's right.	As far as I know …
It seems to be wrong.	To my mind …
I can't agree with it…	On the contrary …
Now I know that…	It is said that…
According to the text …	

TEXT C. HYDROGEN

Hydrogen was obtained in the sixteenth century by the action of sulfuric acid on iron. R. Boyle at the end of the seventeenth century proved that unlike air the gas was inflammable. Lavoisier suggested the name hydrogen (water producer) in 1783, because when the gas burnt in air, water was formed.

Hydrogen compounds are abundant and widely distributed. Water contains about 11% of hydrogen. Hydrogen is present in different proportions in all animal and vegetable matter. Spectroscopic work has shown that hydrogen is present in the atmosphere of the sun.

In the laboratory hydrogen is prepared from water, acids and alkalis. It can be prepared by electrolysis, by the action of metals on water, on acids, on alkalis, by the action of water on the hydrides of the alkali or alkali metals.

Hydrogen is used commercially in the oxyhydrogen blowpipes, for filling balloons, where helium is not available, and in the processes for manufacturing ammonia. It is also used in the hardening of oils. In this case hydrogen is passed through oils which contain unsaturated carbon compounds, containing nickel as a catalyst, and some hydrogen unites with unsaturated compound to form a saturated compound of higher melting-point than the original oil, so that the product is solid and not a liquid.

Words:
inflammable – легкозаймистий
commercially – у промисловості
available – доступний, у наявності
saturated – насичений

EXERCISES AND ASSIGNMENTS

Exercise 1. Read the text without a dictionary.

Exercise 2. Find the sentences in the text where it is said about:

- хто і коли вивчав властивості водню;
- де і в чому міститься водень.

Exercise 3. Describe the ways of obtaining hydrogen in the laboratory (in written form).

Exercise 4. Find and present information about commercial use of hydrogen.

Exercise 5. Define the parts of speech and translate.

Oxide – peroxide – dioxide – trioxide -oxidation – oxidizing – oxygen.
Stable – unstable – stabilize – stability-stabilization.
Soluble – insoluble – solubility – solvent – solubilization.
Sulfur – sulfite – sulfate – sulfuric – sulfurious.
Ferrum – ferrous – ferric.
Apply – application.

Exercise 6. Define the parts of speech of the words. Write down derivatives of the following words.

Scientist, activity, solidify, fraction, comparable, lengthen, depth, quantity, importance, different, useful, uselessness, useless, equal, equation, purify, crystallize, remarkable, combustion, exposure, television, reactive, picture, electrify.

Exercise 7. Translate the sentences paying attention to *some, any, no*.

1. He put some solid into the flask and then added some water.
2. There is something in the flask. Is there anything in the flask?
3. Did he put any substance to the flask?
4. No solid is seen in the test-tube.
5. There is no solid in this retort but solution possesses some colour.
6. Any student can make this simple experiment and analyze the solution in question.
7. We have just read some facts about atoms.
8. The substance no longer remains unchanged.
9. Some substances occur in the form of large crystals.
10. There were no physical changes in both cases.
11. Any body when heated to a sufficient high temperature becomes a source of light.
12. They could not get any papers about commercial application of hydrogen.
13. There is no answer to this question.

14. I noticed some mistakes in your translation.
15. I do not notice any mistakes in your translation.

Exercise 8. Copy out the sentences with the passive voice verb forms. Analyse and translate them.

Exercise 9. Choose synonyms and antonyms.

Liquid, thin, to evolve, rapidly, ordinarily, thick, soluble, stable, to oxidize, to use, solid, insoluble, suitable, to make, to reduce, to liberate, quickly, slowly, unstable, to apply.

Exercise 10. Translate into Ukrainian.

1. If concentrated H_2SO_4 is mixed with H_2O_2 at low temperature, oxygen rich in ozone will be evolved.
2. Dilute aqueous solutions of hydrogen peroxide are used for bleaching.
3. On account of its inertness it is difficult to make nitrogen combine with other elements.
4. The Periodic Law of chemical elements discovered by Mendeleyev created a new era in the history of chemistry.
5. The research of the unknown element was undertaken by a Polish woman living in France, M. Curie, who together with her husband, Pierre Curie, discovered the element she was searching for.

Exercise 11. Fill in the gaps. Try to use as many words as possible.

Hydrogen Peroxide. Properties.

1.There exist a number of peroxide … . 2. The simplest of them is … … . 3. It contains twice as much (вдвічі більше) … for the same weight of … as the simple … , water. 4. Since it readily decomposes, yielding … , hydrogen peroxide is an active … … . 5. It also acts as a … .

Oxygen, hydrogen peroxide, compound, hydrogen, reducing agent, oxide, oxidizing agent.

Exercise 12. Make up as many word-combinations (adjective + noun) as possible.

Acid, substance, solution, density, light, rays, water, surface, lustre, metal, properties, moist, dilute, chemical, physical, alkaline, moist, metallic, hydrochloric, high, ultraviolet.

Exercise 13. Test yourself. Do you know the words?

Quantity, variety, to evolve, dilute, sulfuric acid, current, density, vessel, to expose, exposure, ultraviolet light, mercury, to produce, production, combustion, for instance, surface, moist, moisture, ether, hydrogen peroxide, to pass, tube, rapidly, to issue, zinc, copper, lead, to shake, to treat, treatment, aqueous, solution, hydrochloric acid, to mix, mixture, chloride, on account of.

UNIT 5

Exercise 1. Define the parts of speech of the following words. Read and translate them.

Important, readily, oxidation, practically, combination, electrical, chemist, manifold, synthesis, synthesize, equipment, formation, higher, possible, stable, successful, different, oxidize, reliable,

foundation, uselessly, electrify, mixture, mixed, miscible, mixer, analysis, analyses, analyze, largest, bigger.

Exercise 2. Pronounce correctly the words. Give the initial form of the verbs.

Indicated, passed, reacted, manufactured, fixed, possessed, estimated, regarded, fixes, is, were, taken up, found, been, existing, made, took, decomposed, required, combined, reacts, passing, cooled.

Exercise 3. Translate the words without a dictionary.

Oxide, dioxide, oxidation, react, reactor, practically, combination, combine, process, electrical, total, mixer, mixture, stable, quantitative, manufacture, direct, equilibrium, application, arc.

Exercise 4. Translate the sentences paying attention to *for*:

1. For many centuries there existed an atomic theory.
2. Water is the greatest chemical compound for it enters many chemical reactions.
3. For a reaction to take place, a catalyst must be used.
4. The task was given for me and you.
5. What are pipettes used for?

TEXT A. OXIDES OF NITROGEN

The two most important oxides of nitrogen are nitric oxide, NO, and nitrogen dioxide, NO_2. Nitric oxide reacts readily with oxygen of the air to form nitrogen dioxide at temperatures below 700° C, and at room temperature oxidation is quantitative. Nitric oxide is thus the only oxide that is manufactured directly. All other nitrogen oxides and their derivatives are made from it. Practically all nitric oxide is now made by oxidation of ammonia, but for a number of years most nitrogen was fixed by the direct combination of nitrogen and oxygen when the air was passed through an electric arc. This process required a great deal of electrical energy and is now entirely obsolete. Since the arc process was the first successful nitrogen-fixation method, it possesses sufficient historical interest.

Arc Process. A study of the nitrogen-oxygen equilibrium indicates that the formation of nitric oxide is favoured by the application of heat. Less than 3% of the total energy is taken up in the reaction. Above 2.300° C the time required to reach equilibrium is very short. The higher the temperature, the greater are the yields. The temperature at which the gas is heated in the arc, as it has been estimated, is from 3.200° C to 3.500° C. The reaction mixture must be cooled as quickly as possible after it passes through the electric arc, but the decomposition below 1.200° C is so slow that nitric oxide may be regarded as stable.

EXERCISES AND ASSIGNMENT

Exercise 1. Read the text.

Exercise 2. Find in the text:

A) find and translate the sentences with the Passive Voice.

B) word-combinations:

Діоксид (двоокис) азоту, єдиний оксид, окиснення аміаку, протягом кількох років, більша частина азоту, успішний метод, зв'язування (фіксація) азоту, чим вище..., тим більше..., якомога швидше.

C) the answers to the following questions:
1. What oxides of nitrogen are the most important?
2. What is formed when NO reacts with oxygen of the air?
3. How is nitric oxide made now?
4. Why is the arc process obsolete now?

Exercise 3. Make up sentences.

1. Is, oxide, nitrogen, in, important, chemistry, of.
2. Oxide, ammonia, nitric, is, made, of, by, now, oxidation.
3. Manufactured, nitric, directly, is, oxide.

Exercise 4. Fill in the gaps.

1. Nitric oxide reacts … with oxygen of the air.
2. Nitric oxide is the only oxide that is … directly.
3. Nitric oxide is now made by the … of … .
4. Above 2.300° C the time … to reach equilibrium is very … .
5. The … … must be cooled as soon as possible.

Exercise 5. Agree or disagree with the statements. Use the cliché.

1. Nitric oxide does not react with oxygen of the air.
2. Practically all nitric oxide is now made by the oxidation of ammonia.
3. The arc process requires a great deal of electric energy.
4. The arc process doesn't possess historical interest.
5. The formation of nitric oxide is favoured by the application of heat.

It seems to be wrong (right) … Здається, це невірно (вірно).
I can't agree with you … Не можу погодитись із Вами…
As far as I know … Наскільки я знаю (мені відомо) …
I am afraid, you are mistaken … Боюсь, ти помиляєшся.

Exercise 6. Match synonyms and antonyms.

Readily, employ, to produce, slowly, to apply, decomposition, stable, to obtain, to liberate, before, to get, to give off, unstable, directly, above, fast, to make, to use, cool, totally, hot, entirely, composition, after.

Exercise 7. Give the main ideas of the text completing the sentences.

1. There are two important oxides of nitrogen …
2. Nitrogen dioxide is obtained when …
3. Nitric oxide is now made by …
4. Arc process possesses historical interest for it…

TEXT B. OXIDES

The compounds of the elements with oxygen are called oxides. They can be classified into six main groups: neutral, acidic, basic, amphoteric, oxides, peroxides.

Neutral oxides exhibit no tendency to form salts either with acids or bases. The example is nitrous oxide.

Acidic oxides are oxides which combine with bases to form salts. An example of such an oxide is carbon dioxide which reacts with sodium hydroxide solution forming sodium carbonate. Such oxides often react with water forming acids. A good example is sulfur trioxide which combines with water forming sulfuric acid. Oxides which form acids with water are called anhydrides. Thus, SO_2 is not only called sulfur dioxide but also sulfurous anhydride.

Basic oxides are the oxides which combine with acids to form salts and water. If they are soluble in water they are known as alkalis. Important examples of basic oxides are the oxides of calcium, copper and iron. Basic oxides are always the oxides of metals. Amphoteric oxides behave as an acidic oxide in alkaline solutions and as basic oxide in acid solutions. The examples are oxides of zinc, arsenic, antimony, stannous oxide and lead monoxide.

Peroxides. A true peroxide is an oxide which when treated with dilute acids yields hydrogen peroxide. Peroxides may be thought of as salts of hydrogen peroxide which is known as a weak acid.

Compound oxides are oxides which behave as though they are compounds of two oxides. Familiar examples are Pb_3O_4, Fe_3O_4, Mn_3O_4. The oxides of the elements are among the most important of their compounds. Their properties are very important in relation to the classification of the elements. Thus, boron, carbon, nitrogen, chlorine, etc. form only acidic oxides, whilst sodium, potassium, strontium, calcium, barium, copper, silver, cadmium, mercury, cobalt, nickel, platinum, etc. have oxides with basic properties only. Zinc, aluminium, tin, lead and gold yield amphoteric oxides.

EXERCISES AND ASSIGNMENTS

Exercise 1.Read the text and check yourself.

1. What is called an oxide?
2. What groups of oxides do you know?
3. What are neutral, acidic, basic oxides?

Exercise 2. Transcribe and pronounce the words correctly.

Oxide, classify, basic, amphoteric, nitrous, hydroxide, carbonate, trioxide, anhydride, sufurious, arsenic, zinc, antimony, neutral, cobalt, nickel, platinum, alkali, lead, yield, boron, sodium, potassium, strontium, calcium, mercury, cadmium, aluminium, chlorine, nitrogen, peroxide.

Exercise 3. Ask 4 types of questions to each sentence.

1. Important examples of basic oxides are the oxides of calcium, copper and iron. 2. Basic oxides are always the oxides of metals. 3. Amphoteric oxides behave as an acidic oxide in alkaline solutions and as basic oxide in acid solutions. 4. The examples are oxides of zinc, arsenic, antimony, stannous oxide and lead monoxide.

Exercise 4. Agree or disagree with the statements.

1. Neutral oxides exhibit tendency to form salts with acids and bases.
2. Oxide which does not form acid with water is called anhydride.

3. Sulfur trioxide when combining with water forms H_2SO_4.
4. Compound oxides are oxides which contain many oxides.

TEXT C. PROPERTIES OF NITROGEN

If a glowing splint, burning phosphorous, sulfur or sodium or a stream of burning hydrogen is introduced into a vessel filled with nitrogen, the flame goes out at once, as if the burning substance had been immersed in water. Nitrogen doesn't support combustion and it doesn't burn. In this respect it resembles carbon dioxide. But nitrogen doesn't make lime water turbid.

We pass electric sparks through air. A yellow «flame» appears between the ends of the wires, and a gas with a pungent odour is formed in a vessel. At the temperature of the spark nitrogen combines with oxygen forming nitric oxide NO: $N_2 + O_2 = 2NO$

When the current is switched off, the flame goes out. This is because the oxidation of nitrogen is an endothermic reaction (a reaction in which energy is not evolved but is absorbed). The energy for the oxidation of nitrogen is supplied by the electric current. Therefore, when the current is switched off, the reaction of nitrogen oxidation stops too. The reaction of the combination of nitrogen and oxygen takes place only at a very high temperature such as an electric spark.

Words:
glowing splint – тліюча скіпка
stream – струмінь
as if – неначе, немов, ніби
like – вапно
turbid – каламутний
electric spark – електрична іскра
introduce – вводити
a pungent odour – їдкий запах
resemble – бути схожим
switch off – вимикати

EXERCISES AND ASSIGNMENTS

Exercise 1. Look through the text and tell about the properties of nitrogen which are described in the text.

Exercise 2. Ask 4 types of questions to each sentence.

1. Nitrogen doesn't support combustion and it doesn't burn.
2. In this respect it resembles carbon dioxide.
3. But nitrogen doesn't make lime water turbid.

Exercise 3. Define and compare verbal predicates. Translate.

1. They asked to translate the text. They were asked to translate the text.
2. He tells some fact about metals. He is told some facts about metals.
3. He will refer to the data of her research. The data of her research will be referred to.

Exercise 4. Make up all possible variants of sentences.

The articles	is spoken about	into English
Some questions	will be answered	at the conference
His lecture	are translated	by all the students
Gold	were discussed	by moisture
These data	is not acted upon	by acid
	is attended	by a discussion
	were referred to	
	will be followed	

Exercise 5. Make up a few sentences according to the pattern.

What is your shirt made of? – My shirt is made of cotton.

shoes	gold
socks	cotton
pullover	leather
belt	nylon
ring	silk
necktie	wool

Exercise 6. Analyse verbal forms and translate the sentences.

1. The paper will be published in the journal «Inorganic Chemistry».
2. The conference was attended by many foreign scientists.
3. The composition of the product is affected by addition of chlorine and chloride.
4. The rate of reduction of the amount of oxygen was affected by the oxidizing conditions.
5. The method of preparation of oxygen by the decomposition of potassium chloride Was described in chapter 5.
6. Many experiments are carried out at the laboratory of inorganic chemistry.
7. The importance of D.I. Mendeleyev's discovery is not limited to chemistry alone.
8. At the time when D.I. Mendeleyev published his Table only 63 elements were known.
9. The substance was examined under the microscope.
10. Some new results were obtained by a group of research workers.
11. Physics and chemistry are taught at school.
12. Some of the properties of this substance will be predicted.

Exercise 7. Use the right tense form of the verb and translate the sentences.

1. The Periodic Law of chemical elements (to discover) by D.I. Mendeleyev.
2. The equivalent weight of radium (to determine) and found to be 113.
3. A substance (to undergo) ignition when it (to heat) without direct access of flame.
4. More recently copper salts (to investigate) by many chemists whose papers correct the earlier observations.
5. The first compound of chlorine we (to study) in detail is its compounds with hydrogen.
6. The products of oxidation (to call) the oxides of the elements the compound was composed of.
7. That matter (to exist) in three physical states – solid, liquids, or gaseous is common knowledge.
8. He (to prove) that red phosphorus is less chemically active that the yellow one.
9. Chlorine (to refer to) as diatomic, hence is formula is Cl_2.

10. Gold is hardly (to affect) by nitric acid, sulfuric and hydrochloric acids.
11. The qualitative examination of those compounds (to follow) by the quantitative analysis.
12. Nitrogen does not (to burn), nor does it support burning.
13. The element phosphorus (to locate) below nitrogen in group V of the Periodic Table.
14. At present potassium nitrite (to manufacture) widely at the plants.
15. The changes in these parameters during decomposition (to follow) by a number of other changes.His work in this field (to examine) by the experts next spring.
16. Everybody (to speak) about this new method of product.
17. I (to ask) to attend his lecture on chemistry.

Exercise 8. Form the comparative degree of the following adjectives. Make up your own sentences with them.

Interesting, good, comfortable, warm, fresh, bad, young, slow, weak, difficult, old.

Exercise 9. Make up sentences with the adjectives below as in the pattern.

Pattern:
Nick works harder than Ann.
Nick's job is more difficult than Ann's.

Fast, slow, good, important, careful, bad, short, long, industrious, interesting, near.

Exercise 10. Write a few sentences as in the pattern.

Pattern:
He is very busy. He is one of the busiest persons in the world.

1) She is very intelligent …
2) He is very tall…
3) She is very beautiful…

Exercise 11. Translate the sentences.

The… , the … – чим… , тим…
The most – більшість, більша частина
Mostly – більш за все, головним чином

A. 1. The stronger is the acid, the greater is the tendency to lose protons.
2. The faster the object moves, the greater is the air resistance.
3. The bigger the mass, the bigger the weight of the body.
4. Most elements exist in different forms.
5. Iron is the most important material in industry.
6. Most of all the scientists investigated radioactive elements.
7. We need mostly the polymers which withstand high temperatures.
8. The lower the temperature, the more easily the gas is liquefied.

B. Translate the word-combinations.

Найнижча температура, найвища точка, найбільше число, найцікавіший проект, найсучасніший метод дослідження, найскладніше слово, найкорисніший словник, надсучасне виробництво, найкраща ідея, більш ранні результати.

Exercise 12. Insert the correct form of the adjectives or adverbs given in brackets. Translate into Ukrainian.

Mercury

Mercury is the (small) planet in our solar system. It is the (close) planet to the Sun. Apart from the Sun itself the Sunny side of Mercury is the (hot) place in the solar system. But the dark side of Mercury is probably even (cold) than the (far) planet, Pluto. It is strange to find the (hot) and the (cold) parts of the solar system on the same planet. The (good) time to see Mercury is spring.

UNIT 6

Exercise 1. Define the parts of speech. Translate them.

Greatest, nature, natural, transform, transformer, transformation, desirable, hardly, application, apply, applicable, purify, pure, impure, purification, impurity, soluble, insoluble,solubility, treatment, produce, product, production, productivity, react, reactive, reactivity, decompose, decomposition, contain, container, desire, desirable, wide, widely, condense, condensing, boiler.

Exercise 2. Give the infinitive of the verbs.

Takes place, used, known, dissolved, washing, purified, affected.

Exercise 3. Read and translate the words.

a) influenced, used, purified, referred, filtered, boiled, affected, dissolved, condense;
b) process, microbes, laboratory, distillation, transformation, industry, influence, thoroughly, except, volatile.

Exercise 4. Translate into Ukrainian.

1. Water is a compound substance.
2. The students were carrying out the experiments for many hours.
3. Every student is to know safety rules.
4. Water is colourless when viewed in thin layers.
5. We are five in our family.
6. Our aim was to identify the reaction.
7. All the questions were answered at the lecture.
8. It is to be remembered that analytical balances should be kept in a special room.
9. All the acids have a sour taste.
10. Since iron is expensive, it has to be used very carefully.
11. It has been found that metallic conductors do not undergo chemical change.
12. The students will have to make experiments.
13. After the temperature has been raised, the decomposition accelerated.
14. They had finished their work by 10 o'clock and then had a rest for two hours.

TEXT A. PURIFICATION OF WATER

Water is the greatest chemist in the world. No natural process takes place without it. Chemists could hardly do anything in their laboratories without water. It is impossible to study

the properties of substances or their transformations, to prepare new compounds without water. Water is one of the best solvents. It is known that many substances must be dissolved before they can enter some reactions. Not only does water react with many substances, but many chemical reactions may be influenced by it.

For many processes it is desirable that water should be pure. The choice of the process, which is to be used for purification of water, depends on the application of water and on the impurities which it may contain. For instance, water for washing should not contain substances that react with soap. When water is to be used for drinking it is necessary that the microbes should be killed. To achieve this, water which is to be purified, is thoroughly filtered. Another way to purify water is to boil it.

None of these methods is used for producing pure water in the chemical sense, since most of soluble salts are not affected by the treatment. Here we shall have to remember the fact that water is easily changed into steam while most of the dissolved substances are not volatile. By condensing the steam we shall be able to remove all the impurities except volatile ones. This process is referred to as distillation. Distilled water is widely used both in the laboratory and in industry.

Water used for steam boilers should be free from substances which cause corrosion and scale formation.

EXERCISES AND ASSIGNMENTS

Exercise 1. Match the synonyms and antonyms:

Natural, without, study, prepare, vapour, before, artificial, pure, application, smallest, with, insoluble, greatest, obtain, examine, impure, after, use, contain, desirable, way, slightly, include, manner, undesirable, thoroughly, soluble, steam.

Exercise 2. Fill in the gaps.

1. Water is the greatest … in the world.
2. Many chemical reactions … … by water.
3. Chemists cannot … without water.
4. Water for washing should not contain substances which react with … .
5. Water for drinking should not contain … .
6. To purify water, it is to be … and … .
7. By condensing the steam we are able to remove … except … .
8. Distilled water is used both in … and in … .

Exercise 3. Find the answers in the text.

1. When cannot the chemists do without water?
2. Why is water the best solvent?
3. What does the process of purification of water depend on?
4. What should water for washing not contain?
5. What is it necessary to do when water is to be used for drinking?
6. What ways to purify water do you know?
7. Why is filtration not used for producing chemically pure water?
8. What shall we be able to do by condensing the steam?
9. Where is distilled water used?

Exercise 4. Agree or disagree with the statements. Use the cliché.

1. Water is the greatest physicist in the world.
2. Many substances must be mixed with water before they enter the reaction.
3. Pure water in the chemical sense is to be produced by the process of filtration.
4. It is possible to purify water by boiling.
5. Water used for steam boilers should be pure.

As far as I know...
Far from it
You are right (wrong)
On the contrary
I cant't agree with you
I am afraid, you are mistaken.

TEXT B. WATER

Water is one of the most common of all substances and life would be impossible without it. The seas and oceans cover about seven tenths of the Earth's surface but water is also contained in the soil, in the atmosphere and in all living things. More than half of the human body consists of water, which also forms a large part of the food we eat, especially vegetables and fruits. Man can live for ninety days or a little more without food, but he cannot live long without water.

Water exists as a substance in three states: ice, which melts at 0°C; liquid water and steam, the latter is formed when water boils at 100 degrees Centigrade.

Water differs from other liquids in that

1) it expands when cooled from 0°C,
2) contracts when heated from 0° to 4°C and
3) reaches its maximum density at 4°C. No other liquid possesses this property.

Pure water is rarely found in nature. This is because water is able to dissolve many substances from the air, the soil and the rocks. The saltiness of sea water is caused by the mineral substances which are dissolved from the Earth's surface by rivers and carried down to the sea. The Sun's heat causes the sea water surface to evaporate or to change into vapour, leaving behind the salt and other minerals. That is why the seas are so much more salty than rivers flowing into them.

Fresh water which is accumulated on the earth's surface is known as surface water. Lakes, rivers, reservoirs, streams, swamps and any other natural storage basin contain surface water. Not all surface water areas are natural as there are many man-made lakes and reservoirs. On the other hand, fresh water (from rain, snow or ice melting) which soaks into the soil is known as ground water.

It was long known that there is no life without water. Man can live without clothes, without shelter and for some time without food. But he soon perishes without water. All his food contains water, from about 60% in lean meat to 95% in watery fruit. His body is about 70% of water. The air surrounding him contains enormous quantities of water in the form of vapour. The surface of the earth is 70% water to an average depth of over 4 kilometers. And yet man often does not have enough water.

First of all water is needed by the industry. It is necessary 100 litres of water to produce one kilogram of paper; 600 litres to produce one kilogram of woolen cloth; 3 500 litres for producing one ton of dry cements and 20 000 litres in order to produce one ton of steel. It was established that the needs in water are greatest in India, Indonesia, Nigeria, Brazil, Pakistan, Korea, China and Philadelphia. The total amount of water in existence is about 326 million cubic miles. Every man gets along with less than one per cent of the world's water. But the total population of the world is growing at a rate of 1.7 % annually. So man began treating raw water, filtrating and chlorinating it. He has devised modern methods of collecting, pumping, storing and

distributing water. There are the grand enterprises of taming the rivers, of harnessing their strength to produce power for man's use, preventing floods and using the water for increasing the harvest of the land and providing food for the growing family of man. Perhaps a practical way will be found of making the rain fall where it is most needed. And yet the human suffering and economic loss resulting from inadequate water supplies are so great that bold measures are required. Many diseases are associated with lack of clean water and contaminated water and unsafe water supplies. World water supply is the major concern now.

EXERCISES AND ASSIGNMENTS

Exercise 1. Read the text. Give the main idea of the text.

Exercise 2. Make up the plan of the text and retell the text.

Exercise 3. What new facts did you learn about?

Exercise 4. Give your opinion about the next statements.

Pure water is rare found in nature.
There is no life without water.
World water supply is the major concern now.

TEXT C. CHEMISTRY. THE HISTORY OF ITS DEVELOPMENT

Chemistry is a science which deals with substances, their composition and structure, their properties and mutual conversation. Man began to use chemical processes in ancient times for glass making, dyeing, preparation of pigments, poisons and drugs. But theory lagged behind and was neither connected with practice, nor supported by experiment.

The first theoretical chemistry was the chemistry of Greek chemists Aristotle, Hippocrates, Democritus, Plato and others.

Modern chemistry began with the work of Robert Boyle. He studied the relationship between the volume of a gas and the pressure. In 1748 M. Lomonosov discovered the law of conservation of substance. In 1777 Lavoisier formulated the basis of the process of combustion. He introduced the concept of the chemical elements.

At the beginning of the 19^{th} century John Dalton carried out his work on the atomic theory. A. Avogadro stated that equal volumes of gases under the same temperature and pressure contain the same number of molecules. F. Kekule and A. Butlerov introduced the structural theory of organic chemistry. In 1869 D.I. Mendeleyev discovered regularities in the properties of the elements. The Periodic System of D.I. Mendeleyev was the greatest and the most important achievement of the 19^{th} century.

Many great scientists devoted their life to the development of chemistry. N. Bohr developed the theory of the hydrogen atom, the Curies prepared artficially radio-active elements, Marie Curie discovered radium and polonium, N. Semenov discovered chain reactions, N. Zelinsky made a basis for synthesizing many new compounds and so on.

The future of chemistry is practically unlimited. Rapid development of chemistry will help to create many new goods, machines, plastics, polymers, drugs, fertilizers, etc.

Modern chemistry is divided into several important branches:

1) inorganic chemistry which studies the properties of chemical elements and their mixtures;
2) organic chemistry which deals with the compounds of carbon;
3) physical chemistry which uses physics in studying chemical processes;
4) analytical chemistry which defines the qualitative and quantitative chemical composition of substances;

5) colloidal chemistry which deals with special properties of substances in a finely dispersed condition;
6) electrochemistry which studies the relation between electrical energy and chemical change;
7) nuclear chemistry which studies the transformation of atomic nuclei and reaction between them;
8) biochemistry which studies the process in living organisms.

EXERCISES AND ASSIGNMENTS

Exercise 1. Read the text and answer the questions.

1. What does chemistry deal with?
2. For what purpose did man use chemical processes in ancient times?
3. What Greek chemists are known to you?
4. What discoveries were made by the chemists of the 18th century?
5. What great scientists devoted their lives to the development of chemistry?
6. What branches of chemistry do you study at the University?

Exercise 2. Complete the sentences.

1. Inorganic chemistry studies …
2. Organic chemistry deals with …
3. Analytical chemistry defines …
4. Physical chemistry uses …
5. Electrochemistry studies …

Exercise 3. Tell about the impact of native and foreign scientists into the development of chemistry. Use the model of the Passive Voice.

The first theoretical chemistry* was founded *by Greek scientists.

1. Modern chemistry (to begin) by Robert Boyle.
2. The law of conversion of substance (to discover) by M. Lomonosov in 1748.
3. The basis of the process of combustion (to formulate) by Lavoisier in … .
4. The research on atomic theory (to carry out) by J. Dalton.
5. The structural chemistry of organic chemistry (to introduce) by … and …
6. Regularities in the properties of the elements (to discover) by … in 1869.
7. The theory of the hydrogen atom (to develop) by … .
8. Radium and polonium (to discover) by the … .

Exercise 4. Translate into Ukrainian.

1. Such question can not be answered at once.
2. The rate of the reaction is to be influenced by gas temperature.
3. Einstein's theory of relativity has to be referred to by many researchers.
4. All the instruments should be looked at with great interest for they are widely used in the lab.
5. The liquid was to be allowed to evaporate.
6. This insoluble compound should not be affected by acids.
7. It must be noted that this huge automatic unit is operated by only a few men.
8. It is to be remembered that concentrated acids are very dangerous.
9. All the devices and glassware are to be kept in good order in the laboratory.
10. Nitric acid may be obtained by the reaction of concentrated sulfuric acid with sodium nitrate.

Exercise 5. Fill in modal verbs and their equivalents.

1. … I take this test-tube?
2. A first-year student … … carry out many experiments in the laboratory of inorganic chemistry.
3. You … use this glassware for your experiments.
4. In this experiment we … … find out all the properties of this substance.
5. Hot water … … poured in a flask.
6. You … carry out this experiment again for getting better results.
7. His experiment … help our researchers to finish their work.
8. He knows very much and … make various experiments very well.
9. The gas … … be passed through a glass tube at a low temperature.
10. A good order … be kept at the laboratory.
11. … you measure pressure?
12. Nitric acid … be prepared by the reaction of concentrated sulfuric acid with sodium nitrite.

Exercise 6. Read and translate the text. Make up questions to the text.

Industrial Uses of Gold

Gold (Au) is a metallic chemical element. Atomic number is 79. Atomic weight is 197.2. Gold has a number of industrial uses. About 10% of the annual production is used for industrial processes. Gold is measured in troy ounces (31.1 grams). One ounce can be drawn into 80 kilometres of wire. Between 20 and 30 ounces are needed for every jet engine. Gold coatings, 0.000024 mm thick, are used to reflect heat from jet engine exhausts. The windscreens of Concorde, other high speed aircraft, and some express trains have a gold electric heating element, 0.000005 mm thick, which is used to prevent icing. Spacecraft are protected against radiation by a thin layer of the metal.

As it conducts electricity well and does not tarnish, gold is used extensively in computers and electric consumer goods. For many years it has been blended with oils and applied as decoration to china and glass. Because it is so reflective, it is employed in the manufacture of some roof tiles and glass.

Exercise 7. Make up sentences and translate them.

Gold	was produced	to produce an ounce of gold.
It	is used	in ancient times.
New deposits	has been used	in industrial processes.
Three tons of rock	can be used	in museums.
	may be seen	for 6000 years.
	have to be mined	for many purposes.
	are being found	

UNIT 7

EXERCISES AND ASSIGNMENTS

Exercise 1. Memorize the following word-combinations. Translate the sentences.

1. **On account of** its oxidizing properties moist chlorine will bleach (відбілювати) many substances.
2. **Owing to** its low acidity boric acid is widely used in medicine.
3. Bromine does not unite with hydrogen in sunlight **unless heated.**
4. Nearly all mercuric compounds sublime **at once** when heated.
5. **Thus** sodium acts energetically with water.
6. The substance tarnishes **at once** in the air.
7. These factors are important **enough** for our understanding of the nature of the phenomenon.
8. **Owing to** its properties ozone is readily distinguished (отличается) from oxygen.
9. The presence of a catalyst is not **sufficien**t for the reaction to be started.

On account of – через, внаслідок
At once – відразу, негайно
Owing to – завдяки
Thus – так, таким чином
Unless – якщо ні
Enough, sufficient – досить, достатньо

Exercise 2. Analyse and translate the groups of family words.

Active – activity; conduct – conductor – conductivity; react – reactive – reaction – reactivity – reactor; oxide – oxidize – oxidation – oxidizing agent – peroxide; direct – directly – direction – indirect – indirectly; lustre – lustrious; vigour – vigorous – vigorously; combine – combination; burn – burner – burning.

Exercise 3. Translate without a dictionary.

Intense, chemical, formation, monatomic, conductor, chemically, reactive, mixture, halogen, phosphorus, act, hydroxide, ordinary, globe, globule, brilliant, element, energetically, ammonia.

Exercise 4. Give the initial form.

Found, oxidized, kept, cut, seen, forming, combines, will dissolve, evolved, burning, widely, lighter, most.

TEXT A. SODIUM

Sodium in the form of compound is widely distributed and abundant element but on account of its intense chemical activity it is never found free. Sodium is a silvery-white, lustrous metal which tarnishes at once when exposed to the air owing to the formation of a film of oxide. On account of the ease with which it is oxidized, it must be kept immersed in a liquid containing no oxygen. It is lighter than water (sp. gr. 0.93); it is soft, so that it can be cut with knife, and at ordinary temperature it can be moulded between the fingers. Sodium melts at 97.5°C and boils at 880°. The vapour, which is purple when seen in thick layers, has a density of 12.85 (H_2= 1) indicating that it is probably almost entirely monatomic. Sodium is a good conductor of electricity. Chemically sodium is a very reactive element. It combines vigorously with oxygen, burning readily in air with brilliant, yellow flame, and orming a mixture of the oxide and

peroxide. It combines directly with the halogens and with phosphorus taking fire when heated with these elements. It also combines with hydrogen when heated to 360°. The vigour of its combination with oxygen is such that sodium will react with most oxides liberating the element previously combined with the oxygen. Thus, it acts energetically with water, forming sodium hydroxide and hydrogen and the heat of the reaction is sufficient to melt the sodium which swims, as a globule on the surface of the water. The heat evolved is, however, not great enough to ignite the hydrogen unless large pieces of sodium will dissolve in liquid ammonia forming a blue solution.

EXERCISES AND ASSIGNMENTS

Exercise 1. Read and translate the words and the word-combinations.

Sodium, compound, widely distributed, abundant, element, intense, silvery-white, tarnish, immerse, specific gravity, knife, to mould, finger, purple, indicate, monatomic, entirely, brilliant, halogens, sodium hydroxide, liberating, previously, sufficient, to ignite.

Exercise 2. Find the following words and word-combinations in the text.

У вигляді сполук; рідина, яка не містить кисню; питома вага; майже повністю одноатомний, оксидна плівка; у товстих шарах; загорятися; гарний провідник струму; елемент, заздалегідь з'єднаний з киснем; на поверхні води; рідкий аміак.

Exercise 3. Fill in the gaps.

Widely … and … element
Silvery-white, … metal
Almost … monatomic
A very … element
Liquid … no oxygen
The formation of the … of oxide
The element … combined with oxygen
The … of the reaction
… pieces of sodium

Exercise 4. Complete the sentences.

Sodium is …
It tarnishes when …
It must be kept in a liquid…
It combines with oxygen forming…
It reacts with hydrogen …

Exercise 5. Agree or disagree with the statements.

1. Sodium is not a widely distributed element.
2. When exposed to the air it does not tarnish.
3. Sodium combines directly with phosphorus.
4. It must be kept immersed in a liquid containing oxygen.
5. Sodium is so soft that it can be moulded between the fingers.

Exercise 6. Describe the physical properties of Sodium using the following verbs, nouns and adjectives.

To boil, to melt; conductor, specific gravity, element, substance; light, soft, silvery-white, lustrious.

Exercise 7. Ask 5 questions about sodium. For example,

Is sodium a … ?
Does it react with … ?

Exercise 8. Summarize the chemical properties of sodium. Complete the following sentences.

1. Sodium combines vigorously with …
2. It combines directly with …
3. It acts energetically with …
4. It tarnishes at once when …

TEXT B. FLUORINE

Fluorine doesn't occur in nature.The compounds of fluorine are widely distributed in such minerals as cryolite, fluorspar, etc., and small quantities occur in some micas. It is found in all rocks, thermal waters and vapours coming from beneath the earth's crust.

For many years the isolation of fluorine was one of the main problems in chemistry. Nobody doubted the existance of fluorine but it withstood every attempted method of isolation. Having electrolized the solution of potassium fluoride in anhydrous hydrogen fluoride, Moissan finally solved this problem in 1886.

Fluorine is a light canary-yellow gas condensed to a clear yellow liquid boiling at – 187°. It freezes to a pale yellow solid melting at –223°. When cooled at – 252°, the solid becomes colorless. Fluorine is the most active element known. It combines with hydrogen when exploding. While decomposing water, it forms hydrogen fluorine and liberates oxygen. All metals are acted upon by the gas.

Silicon, phosphorus and glass are not influenced by liquid fluorine. It never reacts with nitrogen, oxygen and chlorine even at high temperatures.

Glass is not attacted by fluorine. Fluorine is a very powerful agent. It decomposes water, evolving oxygen charged with ozone. Being combined with halogens, fluorine forms a variety of interhalogen compounds.

EXERCISES AND ASSIGNMENTS

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

1. In what minerals are the compounds of fluorine widely distributed?
2. Why was the isolation of fluorine one of the main problems for many years?
3. What method did Moissan use for obtaining fluorine?
4. What solution did he electrolyze?
5. What kind of gas is fluorine?
6. Why is chlorine the most active element known?

Exercise 2. Entitle each paragraph of the text.

Exercise 3. Write out the key words to each paragraph of the text.

Exercise 4. Retell the text using your own plan.

DISCUSSION:

1. What do you know about the scientist G.J. Berzelius t and his discoveries?
2. In 1886 A. Moissan obtained fluorine by means of electrolysis of the solution of potassium fluorine in anhydrous hydrogen fluoride. What do you know about this discovery?

TEXT C. A. MOISSAN (1852-1907)

A.Moissan is one of the famous French chemists, a professor of the University of Paris.

He was a skilful experimentator. He managed to evolve fluorine after the attempts of other chemists had failed. He simplified an electric arc furnace that made it possible to study many reactions which usually take place only at high temperature. Moissan found that if potassium fluoride was dissolved in the liquid hydrogen fluoride at –23°C, hydrogen was evolved at the cathode and fluorine at the anode. The primary products of electrolysis are fluorine at the anode and potassium at the cathode. The potassium reacts with hydrogen fluoride reforming potassium fluoride and liberating hydrogen.

A.Moissan investigated carbides of many metals. His results were summarized in the monographs «Fluorine and its Compounds» (1900) and «Electric Arc Furnace» (1897).

He published the «Course of Mineral Chemistry». In 1906 Moissan was awarded the Nobel prize for his method of evolving fluorine and for using electric furnace in science. Later on electric furnace was named after him.

EXERCISES AND ASSIGNMENTS

Exercise 1. Read the text and name A.Moissan's investigations.

Exercise 2. Use the given information and complete the following sentences.

A. Moissan managed to evolve …
He simplified …
He investigated …
He published…
He was awarded …

Exercise 3. What Nobel laureates do you know?

Exercise 4. Read and translate the text. Find information about Ukrainian Nobel laureates.

The 2000 Nobel Prize for physics went to Jaures Alfyorov, a Russian scientist, vice president of the Russian Academy of Sciences and director of the St.Petersburg – based Ioffe Institute of Physics and Engineering. He shared the prize with two Americans: Herbert Kromer and Jack Kilby. The Swedish Royal Academy of Sciences awarded the physicists for their work in modern information technology, which, in particular, led to the microchip, laser diodes, and super-fast semiconductors, mobile phones and satellite links. Due to their researchers small electronic apparatuses, anything from electronic watchers and TV games to mini-calculators and personal computers, appeared in our every day life.

Jaures Alfyorov is the eighth Soviet/Russian Nobel laureate in physics. In 1958, Pavel Cherenkov, Igor Tamm, and Ilya Frank were awarded the Nobel Prize for discovery and interpretation of the Cherenkov's effect. In 1962, the prize went to Lev Landau for developing fundamental theories of condensed matter, in particular liquid helium. In 1964, Nikolai Basov

and Alexander Prokhorov shared the prize with Charles Townes for fundamental work in the sphere of quantum electronics, leading to maser-laser-based generators and amplifiers. And finally, in 1978, the Nobel Prize was awarded to Pyotr Kapitsa, Arno Penzias, and Robert Wilson for fundamental inventions and discoveries in low temperature physics.

Exercise 5. Read the sentences, translate them and make up your own sentences.
Use the word combinations: ***to wash the glassware, to cool the substance, To evaporate the liquid, to control the temperature, etc.***

1. The mixture heating in a vessel will soon boil.
2. When heating this mixture we were very careful.
3. Heating this mixture they used a gas burner.
4. When heated, the mixture changes its colour.
5. Having heated the mixture, they were to measure its temperature again.
6. Having compared these two substances …
7. When comparing these substances …
8. Comparing these substances …
9. Having compared this element …
10. Examining this liquid …

Exercise 6. Translate into Ukrainian.

1. Any material studied should be first purified.
2. When dissolved in cold water, the acid reacted slowly.
3. The substance influenced by heat decomposed.
4. The increased concentration of the ions of water increased the affects caused by these ions.
5. The compound heated melted slowly.

Exercise 7. Translate according to the model.

The experiment **followed by a lecture** lasted 2 hours.
Експеримент, після якого була лекція, тривав дві години.

1. The state of water **affected by cooling and heating** is greatly changed.
2. The questions **answered at the lecture** were summarized and discussed.
3. The substance **acted on by magnetic field** must be a metal.
4. The data **referred to in the report** were of great importance.
5. The changes in a state or a form of a substance **spoken of as physical changes** are called physical properties of this substance.
6. The analysis **followed by an examination** gave unexpected results.
7. Radioactivity is the property **uninfluenced by any known catalyst**.
8. **Owing** to their experiments chlorine was **referred to** as diatomic.

Exercise 8. Translate and give the correct form of the Participle in brackets.

1. The work (виконана) in time was very important.
2. (При охолодженні) to the original temperature the substance becomes solid.
3. The new experiment (про який говорили) so much will be carried out again very soon.
4. The piece of ice (занурений) in the water began to melt.
5. (При нагріванні) ice melts.
6. The text (перекладений) by him was very useful for our work.
7. The new device (показаний) by our professor was very interesting.

8. (При охолодженні) the steam turns back to water.
9. (Відкривши) these and many other similar substances, the researchers could answer the question.
10. Most atoms contain (незаряджені) particles (які називаються) atoms.

Exercise 9. Translate the parts of the sentences.

1. When heated sufficiently …
2. If cooled to 20°C …
3. Translated into Russian …
4. Unless heated …
5. The question involved…
6. When removed…
7. Produced at the plant …
8. If examined under a microscope…
9. When produced at the plant…,
10. If moulded between the fingers…
11. When changed greatly…
12 .Having cooled the substance … .

Exercise 10. Translate into Ukrainian.

1. The density, the concentration of dissolved gases and the temperature studies established the optimum conditions for this process.
2. We passed the gases through the mixer spoken of and then measured the pressure obtained.
3. Being treated with certain chemicals wood can be used instead of metal.
4. Having investigated the influence of temperature we came to a conclusion mentioned in the article.
5. When separating a pure substance from a mixture you should provide for possible mistakes concerning the purity of the substance.
6. Having been separated from a mixture, a pure substance was investigated under microscope.
7. The experiments carried out at our laboratory resulted in many new investigations in the field of ceramics.
8. A change accompanied by the evolution of heat is described as exothermic, while a change in which heat is absorbed is called endothermic.
9. Having examined the new work carried out by our research workers we could say that various lines of technological progress, ranging from the invention of new devices to the development of some industrial chemical processes were characterized by a steady improvement.
10. The results obtained were in good agreement with the values involved.
11. Having learned the weight of hydrogen and oxygen, the research-workers could determine the ratio of two elements.
12. The number of papers dealing with the electro-oxidation of the element is very limited.

UNIT 8

Exercise 1. Memorize the meanings of the folowing word combinations. Translate the sentences.

According to – згідно з;
In excess – в надлишку;
By means of – за допомогою;
To stand – витримувати, виносити;
In contact with – при взаємодії;
To the extend of – у кількості, у розмірі.

1. The formation of these red fumes in contact with oxygen is the characteristic of this gas.
2. Nitric oxide is able to stand a dull red heat without decomposition.
3. By means of this reaction nitric oxide may be separated from other gases.
4. According to P. Jolibois, this process takes place at a very high temperature.
5. The trioxide is formed to the extend of 34 % in 20 seconds.
6. Even if oxygen is supplied in excess, the time required for the formation of the peroxide is of the same order.

Exercise 2. Translate the words without a dictionary.

Atmospheric, combination, stable, separate, regeneration, trioxide, proportion, ferrous sulphate, critical temperature, partial, seconds, transformation, equilibrium.

Exercise 3. Read and memorize.

Nitric oxide, colourless gas, specific gravity, atmospheric oxygen, red brown vapours, nitrogen dioxide, rise of temperature, red fumes, characteristic, thereby, distinguishing, sparingly, dull red heat, ferrous sulfate, dark-brown solution, separated, difficultly, liquefiable, critical temperature, is required, partial regeneration, instantaneous, stage, subsequently, complete, supply, supplied, excess, submitted.

Exercise 4. Analyse the following words.

Colour – colourless; soluble – insoluble – solution – solubility; stable – unstable – stability; liquid – liquefy – liquefiable – liquefaction; subsequent – subsequently; decompose – decomposition; regeneration – reduction; nitric – nitrous; equal– equilibrium – equilizer.

Exercise 5. Find the pairs of synonyms and antonyms.

Vapour, readily, similar, sparingly, stable, reduction, absence, total, slowly, changes, steam, evolve, require, unstable, steady, same, fairly, demand, partial, presence, rapidly, oxidation, transformations, liberate.

TEXT A. NITRIC OXIDE, NO

Nitric oxide is a colourless gas, having a specific gravity of 1.39. When brought into the air it combines with the atmospheric oxygen, forming red-brown vapours, consisting of nitrogen dioxide, the combination being attended by a rise of temperature. The formation of these red fumes in contact with the oxygen is the characteristic of this gas, thereby distinguishing it from all other gases.

Nitric oxide is only very sparingly soluble in water. It is the most stable of all the oxides of nitrogen, being able to stand a dull red heat without decomposition. It is soluble in a solution of ferrous sulfate, forming a dark-brown solution, containing an unstable compound of ferrous sulfate and nitric oxide being evolved. By means of this reaction nitric oxide may be separated from other gases. Nitric oxide is a difficultly liquefiable gas, its critical temperature being –93.5°C; at this temperature a pressure of 71.2 atmospheres is required to liquify it.

In the presence of water nitric oxide is oxidized to nitrogen trioxide, the trioxide then being decomposed by water with formation of nitric acid and partial regeneration of nitric oxide.

According to P. Jolibois, when nitric oxide and oxygen are mixed in the proportion of 4:1 by volume, combination is instantaneous at the ordinary temperature, nitrogen trioxide N_2O_3 being formed and remaining stable. If the gases are mixed in the proportion of 2:1, the combination very rapidly reaches the stage N_2O_3 and subsequently the trioxide is formed to the agent of 34 % in 20 seconds, transformation being complete after 100 seconds; even if oxygen is supplied in excess the time required for the formation of the peroxide is of the same order. If the nitrous vapours are submitted to a temperature of 400°C, the equlibrium tends towards N_2O_3.

EXERCISES AND ASSIGNMENTS

Exercise1. Read the text and answer the following questions.

1. What is the characteristic of NO in contact with oxygen?
2. Why is NO the most stable of all the oxides of nitrogen?
3. What solution is NO soluble in?
4. What reaction may be used to separate NO from other gases?
5. What is formed when NO combines with O_2 in the proportion of 4:1?

Exercise 2. Fill in the gaps.

Nitric oxide is a … gas. Its specific … is 1.39. When brought into the … it combines with … oxygen, forming red-brown … . Nitric oxide is only sparingly … in water. It is the most … of all oxides of nitrogen. It is soluble in a solution of … , forming an … compound of ferrous sulfate and nitric oxide. Nitric oxide is …. at –93.5° C. A … of 72.2 atmospheres is required to … it.

Exercise 3. Insert the verbs.

1. In the presence of water nitric oxide _____ to nitrogen trioxide, the trioxide then _____ by water.
2. Even if oxygen _____ in excess, the time _____ for the formation of the peroxide _____ of the same order.
3. When nitric oxide and oxygen _____ in the proportion of 4:1 by volume, combination _____ instantaneous at the ordinary temperature.
4. If the gases _____ in the proportion of 2:1, the combination very rapidly _____ the stage of H_2O_3.

Exercise 4. Agree or disagree with the following statements. Use the phrases.

Sorry, I do not know…
I can't agree with you…
It's correct…
It's wrong…
I'm not sure …

1. The first paragraph speaks about the chemical properties of NO oxidation.
2. The second paragraph describes the physical properties of NO.
3. The third and the fourth paragraphs deal only with chemical properties of NO, such as mixing up and oxidation.

Exercise 5. Complete the sentences.

1. Summarizing the information of the text we can say that the 1st paragraph speaks about … .
2. The second paragraph is about … .
3. The third paragraph deals with … .
4. Such properties of NO as … … … … are described in the text.

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oxidation, solubility, regeneration, odour, lustre, melting point, boiling point, density, colour, specific gravity, decomposition, liquefaction, size, weight, mixing up, hardness

Exercise 6. Describe in English.

Situation:

1. A student should dissolve NO.
2. A student should distinguish NO from other gases.
3. A student describes NO properties.

TEXT B. NITRIC ACID, HNO_3

Nitric acid is formed in the atmosphere by lightening causing combination of the oxygen and nitrogen of the air. J. Priestly (1775) first noticed that an acid is formed when electric sparks are sent through the air, but he thought that the acidity was due to carbonic acid. H. Cavendish (1785) proved that the product of the action was nitric acid while Berthelot showed that nitric oxide (NO) was an intermediate stage in the process.

HNO_3 is now manufactured in three ways, viz:

(a) from sulfuric acid and sodium nitrate;

(b) by the combination of the nitrogen and oxygen in the air;

(c) by the oxidation of ammonia.

Nitric acid is a colourless mobile liquid which fumes strongly in air. It has a peculiar odour. The pure acid being hydroscopic, it absorbs moisture from the air. The pure acid boils at 86°C and freezes at – 42°C. Nitric acid is readily decomposed by heat.

The principal chemical properties of HNO_3 are divided into three main groups. It can act in its reactions as

(a) an acid;

(b) an oxidizing agent;

(c) a nitrating agent.

It is a very strong acid. It exhibits the usual general properties of acids; it reacts with basic oxides, hydroxides, carbonates, the corresponding salts being formed. Nitric oxide is a powerful oxidizing agent. It oxidizes sulfur to sulfuric acid, phosphorus to phosphoric acid. Nitric acid reacts with many organic compounds, oxidizing them to carbon dioxide and water. But in many cases it causes the replacement of one or more hydrogen atoms of the organic compound by the $-NO_2$ radical which is known as nitro-group. This process is known as nitration and is of great theoretical and practical importance.

Nitric oxide finds many applications both in the laboratory and in industry. In the former it is often employed as oxidizing agent; for example, in the preparation of metallic oxides, oxiditative analysis. It is an important reagent in organic chemistry both for oxidation and nitration.

Industrially it is used in large quantities for the production of all kinds of explosives, many nitro compounds being used as intermediates, e.g., in the dye industry in the preparation of sulfuric acid, for cleaning metals. It is also an essential raw material for the production of many modern plastics and lacquers.

Words:
G. Priestly (1733-1804) – Джозеф Прістлі, англійський хімік;
H. Cavendish (1731-1810) – Генрі Кавендиш, англійський хімік;
C. Berthelot (1827-1967) – П'єр Эжен Марселен Бертло, французський хімік;
Viz. – а саме
The former – попередній (із згадуваних)

EXERCISES AND ASSIGNMENTS

Exercise 1. Make up the plan of the text. Put the given into the correct order.

- Chemical properties
- Discovery
- Application in industry
- Application in a chemical lab
- Preparation
- Formation.
- Occurence
- Physical properties

Exercise 2. Give the key words to each paragraph of the plan.

Exercise 3. Describe the properties of the Nitric Acid. Use the following:

verbs: to be, to have, to possess, to boil, to absorb, to freeze, to melt, to decompose;
nouns and adjectives: liquid, colour, odour, solid, hydroscopic, peculiar.

Exercise 4. Complete the following sentences.

1. Nitric acid is a … acid.
2. It reacts with oxides and hydroxides forming … .
3. It combines with organic compounds oxidizing them to … .
4. It oxidizes sulfur to … .

Exercise 5. Tell about the application of the Nitric acid, use the given information.

Nitric acid	is used as (in)	як важливий реагент в органічній хімії. як окислювач. для отримання кисневих кислот. для окислення солей. для виробництва вибухових речовин. як сировина для отримання лаків і фарб. у фарбувальній промисловості.

Exercise 6. Agree or disagree with the following statements.

1. HNO_3 is now made by the oxidation of ammonium.
2. HNO_3 cannot absorb moisture from the air.
3. It is used for oxidation of ferric to ferrous salts.
4. It is often employed as an oxidizing agent.

Exercise 7. Describe one of the methods of getting of the Nitric acid in the lab.

TEXT C. HYDROGEN

The element hydrogen occurs free in nature in comparatively small quantities. The atmosphere contains about one volume of H_2 per 15000 – 20000 volumes of air. H_2 is also present in volcanic gases. Combined hydrogen is common. Water contains 1/9 of its weight of hydrogen. Hydrogen together with O_2 is one of the main constituents of animal and vegetable tissue. Hydrogen is also present in allmost all organic compounds and in many gases.

For general laboratory work hydrogen is prepared by the action of dilute hydrochloric acid or sulfuric acid on granulated zinc. The most important industrial methods for making hydrogen are extracting gas from water by electrolysis.

Hydrogen is a colourless gas, tasteless and odourless. It is combustible, but non-supporter of combustion. Its specific gravity is very low in comparison with air being only 0.08987 gr. per litre. H_2 is not very soluble in water, 100 volumes of water at 0° absorbing about 2.15 volumes of gas. Hydrogen was once used as the standard for the atomic weights since it is the lightest element known. It is not poisonous. The critical temperature for hydrogen is –239°C, it is a very difficultly liquefiable gas. The liquid hydrogen is clear and colourless, resembling water. It solidifies when a liquid is evapourated in a partial vacuum. The white solid is crystalline.

Hydrogen doesn't react at room temperature in the absence of catalysts. Hydrogen combines with many nonmetals, but doesn't react with metals at all. The readiness with which hydrogen will combine with oxygen and certain other non-metals makes it able to remove oxygen and chlorine from their compounds with the other elements. Thus, when hydrogen is passed over hot ferric oxide, lead oxide, nickel oxide, etc., hydrogen combined with the oxygen of the oxide leaves behind the metal. In these experiments hydrogen is oxidized and the metallic oxide is reduced or dioxidized. At present hydrogen is employed in the manufacture of synthetic ammonia, for hydrogenation of oils. Large quantities are also used for filling balloons and airships. It is still employed for fusing quartz and silicas, for melting platinum, for autogenous soldering of lead and so on.

Words:
constituent – складова частина
to resemble – походити, бути схожим
to evaporate – випарювати
to fuse – плавити
silica – двоокис кремнію
soldering – пайка м'яким припоєм

EXERCISES AND ASSIGNMENTS

Exercise 1. Read the text and find the following information.

1) industrial getting of hydrogen;
2) its application;
3) its spreading in the nature;
4) its properties.

Exercise 2. Guess the name of the acid. Use the following cliché.

This acid is a useful drying agent. It acts upon solid and liquid substances depriving them of water or even decomposing the substances.
Wood, paper, sugar, starch (крохмаль) are blackened by the concentrated acid owing to the separation of carbon which accompanies removing the elements of water. This property is used for preparation of carbon monoxide and ethylene.

Concentrated acid does not react with metals in the cold but when heated oxidizes them. This is due to the fact that this acid is an oxidizing agent when hot.

As far as I know ...
If I am not mistaken it is … acid, because …
To my mind ...

Exercise 3. Traslate into English. Use the words from the right column.

Якщо шматок натрія *опустити* у *хімічний*	place
посуд з водою, то відбудеться	beaker
бурхлива реакція. Натрій буде *рухатися*	vigorous
по поверхні води, *витісняючи*	move
з неї газ. Натрій буде швидко *плавитися*, так як	displace
виділяється багато тепла. Взаємодія натрію	melt
з водою відбувається *згідно* реакції	evolve
$2Na + 2H_2O = 2 NaOH+H_2$	according to
Який газ витісняється з води?	

Grammar Study: Absolute Participial Construction

1. **Water is** a chemical compound of oxygen and hydrogen, **the latter gas** <u>**forming**</u> the two-thirds of its volume.
   Вода – це хімічна сполука кисню і водню, до того ж водень утворює дві третини її об'єму.
2. **Rain** <u>**falling**</u> on the ground, **the soil absorbs** the water.
   Коли дощ падає на землю, грунт поглинає воду.

1. <u>The salt</u> separates from freezing water, *the ice* **being** quite pure.
2. <u>Water</u> is never absolutely pure in nature, <u>the amount of impurities</u> **depending** on the locality.
3. <u>The experiments</u> with water containing substances **being** very interesting, <u>we</u> worked readily.
4. <u>The range of water application</u> **being** very wide, <u>the scientists</u> are interested in them.
5. <u>The experiment</u> **being** very difficult, he has to spend much time in the <u>laboratory.</u>
6. <u>Rain water</u> **being examined** with a magnifying glass, <u>they</u> saw many impurities.
7. A gas can be dissolved in liquid, <u>the latter</u> **changing** its boiling point.

Exercise 4. Find the sentences with Absolute Participial Construction.

1. A solution containing no excess of an acid, we can call it a neutral one.
2. A solution containing no excess of an acid is known as neutral solution.
3. All the properties of the element having been described, it was easier to use it.
4. Having carried out a series of analyses, he could make some interesting conclusions.
5. A gas can be dissolved in a liquid, the liquid changing its boiling point.
6. Simple substances consist of atoms, each substance having its own special atom.

7. It being necessary to precipitate stannic sulfide SnS_2, hydrogen sulfide is used in this case.

Exercise 5. Translate the sentences.

1. A long series of experiments having been carried out, they determined what equipment modifications would be necessary.
2. Oxygen combines with most elements, the product formed being called an oxide.
3. The gas being colourless, we did not notice its formation.
4. The specific heat of solid element being known, the approximate atom weight can be calculated.
5. There exist a number of peroxy compounds, hydrogen peroxide being the simplest.
6. Soluble barium salts being poisonous, care is taken to remove them.
7. In the process of chemical transformation the atoms are only rearranged, their number remaining the same.

Exercise 6. Translate into Ukrainian.

1. A mixture of two gases being exposed to the action of a solvent, the quantity of each gas dissolved by the liquid depends on the amount and the solubility of each gas that is present in the mixture, each gas behaving as if the others were absent.
2. A number of investigations have been carried out using a procedure in which no absolute values need to be known, all the results being referred to an arbitrary chosen substance, such as benzoic acid.

Check yourself. Do you know the following words?

To consist of, to attend, to rise, rise, in contact, to be characteristic of, to distinquish, stable, to stand, to contain, by means of, to separate, to liquefy, to require, partial, to generate, to regenerate, regeneration, to mix, to remain, to reach, stage, complete, to supply, excess, to submit, equilibrium.

UNIT 9

Exercise 1. Translate the sentences.

Most of + noun – більшість, більша частина
Most of the experiments, most of the metals, most of the reactions, most of the acids.
Most of the experiments were carried out successfully.

Owing to – завдяки, внаслідок
Owing to its properties ozone is readily distinguished from oxygen.

By means of – за допомогою
When H_2 is obtained by means of the reaction between water and a metal, iron is usually used.

A number of – цілий ряд, визначена кількість
There is a number of gases differing from atmospheric air in their properties.

Except (for) – за виключенням
Sodium is very unlike the metals, except that it has a metallic lustre.

To add on – приєднувати, додавати

Some compounds can react by adding on other elements or groups of elements.

Exercise 2. Translate without a dictionary.

Constant, covalency, position, Periodic Table, atom, methane, group, ethane, propane, butane, pentane, hydrocarbons, aliphatic, series, formula, homologous, aromatic, heterocyclic, pyridine, products.

Exercise 3. Read and memorize.

Compound, exhibit, peculiar, linkage, chain, respectively, straight, net, increase, general, as follows, saturated, unsaturated, addition.

Exercise 4. Translate the words.

Exhibit – exhibition; covalent – covalency; combine – combination; add – addition – additional; link – linkage; place – replace – replacement; similar – similarity; differ – different – difference; oxide – oxidize – oxidation – monoxide – peroxide – hydroxide.

Exercise 5. Give the initial form.

Exhibits, combining, replaced, is, higher, being, the simplest, underwent, merely, unsaturated, namely.

Exercise 6. Give the synonyms.

Large, similar, combine, exhibit.

TEXT A. CLASSIFICATION OF ORGANIC COMPOUNDS

In most of its compounds carbon exhibits a constant covalency of four.
Probably owing again to its peculiar position in the Periodic Table the carbon atoms has the property of combining with other carbon atoms by means of one or more of its covalent linkages to from chains of atoms. Thus, one hydrogen atom of methane can be regarded as being replaced by a CH_3 grop in ethane.
Similarly chains of three, four, five, etc. carbon atoms may be obtained producing propane, butane, pentane, and the higher hydrocarbons respectively.

Compounds which contain straight chains of carbon atom are called aliphatic compounds. Introducing each carbon atom removes one hydrogen atom and replaces it by one carbon atom and three hydrogen atoms, the net increase being one atom of carbon and two of hydrogen. In this way a series of compounds is obtained, each number of which differs in formula from the member above or below it by a constant difference, namely CH_2.

Such a series is called a homologue series. Every member of the series can be expressed by the general formula: CnH_2n_{+2}. The simplest homologue series begins with methane, CH_4, and is as follows: methane, ethane, butane, penthane.

In a large number of organic compounds the carbon atoms instead of being straight chains form closed rings containing six carbon atoms. Such substances are called aromatic compounds and if they contain in the ring atoms other than carbon, they are called heterocyclic, for example, pyridine.

The hydrocarbon methane with its four covalent linkages can not undergo chemical reactions to form a covalent compound except by removing one or more hydrogen atoms and their replacement by other atoms or groups. A compound such as methane is called saturated.

Compounds which can react merely by adding on other elements or groups of elements are called unsaturated and form addition products.

EXERCISES AND ASSIGNMENTS

Exercise 1. Answer the questions.

1. What property has the carbon owing to its position in the Periodic Table?
2. What compounds are called aliphatic, aromatic?
3. What is the difference between saturated and unsaturated compounds?
4. What valence has carbon in its compounds?
5. What formula is expressed each member of homologue series?

Exercise 2. Agree or disagree using the phrases:

As far as I know ...
Far from it...
You are right (wrong)...
On the contrary ...
I can't agree with you...
It's not true to the fact...
I am afraid, you are mistaken...

1. One hydrogen atom of methane can be regarded as being replaced by CH_3 group in butane.
2. The simplest homologous series begins with pentane.
3. The carbon atom can form closed rings containing six carbon atoms.
4. The hydrocarbon methane can undergo chemical reactions forming covalent compound.
5. A compound such as methane is called saturated.

Exercise 3. Make up sentences.

The compounds	1) which cannot undergo chemical reactions to form covalent compounds 2) in which carbon atoms form closed rings containing other atoms than carbon 3) in which carbon atoms form closed called rings containing six carbon atoms 4) which contain straight chains of carbon atoms 5) which react by adding on other elements or groups of elements	***are called***	aromatic aliphatic heterocyclic saturated unsaturated

Exercise 4. Fill in the gaps.

1. The hydrocarbon methane with its four covalent linkages cannot _____ chemical

reactions to form a covalent compound except by _____ one or more hydrogen atoms.
2. Every member of the series can be _____ by the general formula.
3. In most of its compounds carbon _____ a constant covalency of four.
4. Chains of three, four, five, etc. carbon atoms may be _____.
5. Each member of the series _____ in formula from the member above or below it by a constant difference.

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to produce, to exhibit, to differ, to undergo, to remove, to express

TEXT B. MAGNESIUM

Magnesium occurs in nature combined in minerals, in sea-water. It is now manufactured on a large scale by the electrolysis in fused carnallite – a double magnesium potassium chloride or of a mixture of magnesium and sodium chlorides. It can also be made by the electrolysis of magnesia in a fused mixture of magnesium, barium, and sodiulm fluorides; and by the action of metallic sodium on magnesium chloride.

Magnesium is a silvery-white metal of low specific gravity (1.74). It melts at 659°C and boils at 1110°C. It is not affected by air at ordinary temperatures, but when heated it burns in air giving a brilliant white light of great actinic power.

It reacts readily with most non-metals, e.g. halogens, sulphur, phosphorus, etc. Magnesium reacts very slowly with water at ordinary temperature and rather less slowly at 100°C. It reacts readily with dilute acids, liberating hydrogen. It is not affected by the solutions of alkalis. Magnesium reduces most oxides, it will also reduce sodium and potassium oxides on heating.

Magnesium in the form of ribbon is familiar in laboratories; likewise the brilliant white light with which it burns.
This property is used in the flashing photography. On account of its lightness it is used as an engineering metal particularly in the form of «light alloys». In the laboratory magnesium is used for the reduction of oxides such as silica, in the preparation of silicon, and as a reducing agent.

Words

ribbon – стрічка
flashing – спалах
alloy – сплав

EXERCISES AND ASSIGNMENTS

Exercise 1. Read and make the plan of the text.

Exercise 2. Give the key words to each paragraph of the plan.

Exercise 3. Fill in the table about Mg.

Occurrence	Manufacture	Properties		Application
		Physical	Chemical	

Exercise 4. Retell the text.

Exercise 5. Complete the sentences.

The text is about … .
… are spoken of in details.
… are discussed.
Much attention is paid to … .

TEXT C. DETERMINATION OF EQUIVALENT WEIGHT OF CALCIUM

Methods for finding the equivalent weight of an element involving the use of the oxide may be subdivided in such a way:

(a) direct oxidation (direct synthesis);
(b) indirect oxidation (indirect synthesis);
(c) reduction of the oxide (analysis).

Direct Oxidation. The direct procedure which is to be followed depends on the nature of the element and on its oxide. If a solid element burns slowly to a solid oxide, the conversion can be carried out in a crucible. If a gaseous oxide is formed as in the case of carbon, a suitable means for discovering the weight of the oxide should be devised. For gaseous elements like hydrogen a special technique has to be employed. This method may be illustrated by experiments with calcium and with carbon.

The equivalent weight of calcium is estimated by placing in a weighted crucible a known weight of calcium turnings and by heating gently until the calcium burns. Heating continues until all the process is over. The crucible is then allowed to cool and a few drops of water are added from the pipette, the addition being made very carefully in order to avoid any loss to the vigour of the reaction. The crucible is then heated, cooled in dessicator and reweighted.
It is then repeatedly reheated, cooled and reweighted until a constant weight is attained.

From these weightings it is possible calculating the weight of O_2 that has combined with a known weight of calcium. Hence, the weight of calcium which would combine with 8 grams of oxygen (i.e. equivalent weight of calcium) can be calculated.

Words:
to weigh – зважувати
weight – вага
cruicible – тигель (нім. Tiegel) – посудина для плавлення або нагрівання різних матеріалів
a few drops – декілька крапéль
until – поки, до тих пір
dessicator – ексикатор
to attain – досягати
hence – отже, отож

EXERCISES AND ASSIGNMENTS

Grammar Study: Gerund

Calculate + ing, experiment + ing, smoke + ing
Calculating the data
In calculating the data
By calculating the data
For calculating the data
The method of experimenting
No smoking

Exercise 1. Analyse and translate.

1. **By + GERUND:** by processing – під час обробки, обробляючи
by boiling (кип'ятити)
by performing (виконувати)
by mixing (змішувати)
by producing (виробляти)
by obtaining (отримувати)
by discovering (відкривати)
by reducing (відновлювати)
by separating (відокремлювати)

2. **For + GERUND:** for cooling – для охолодження
for changing (змінювати)
for saturating (насичувати)
for introducing (вводити)
for combining (з'єднувати)
for employing (застосовувати)
for replacing (заміщувати)
for showing (показувати)
for treating (обробляти)
for separating (відокремлювати)

3. **Without + GERUND:** without heating – без нагрівання, не нагріваючи
without precipitating (випадати в осад)
without drying (сушити)
without decomposing (розпадатися)
without diminishing (зменшувати)
without displaying (проявляти)
without tarnishing (темніти)

4. Compare the Participle (1) and the Gerund (2). Give your examples.

(1) boiling water – вода, що кипить
a smoking man – чоловік, що курить
a reading girl – дівчина, яка читає

(2) a boiling point – точка кипіння
a smoking room – кімната для куріння
a reading room – читальний зал

Exercise 2. Analyse the functions of the Gerund in the sentence.

The Subject:
Solving practical problems is a difficult job (рішення, вирішувати).

The Predicative:
Our aim is solving practical problems (рішення, вирішити).

The Object:
He likes solving difficult problems (вирішувати, рішення).
I know of the problem having been solved (про те, що задача була вирішена).

The Attribute:
The way of solving the problem is not easy (рішення).

The Adverbial Modifier:
In solving the problem we made some mistakes (вирішуючи, під час вирішення).
On solving the problem he proceeded to make experiments (вирішивши).
By solving the problem he got the required results (вирішуючи, вирішивши).
You cannot make the experiment without solving the problem (без рішення, не вирішивши).

Exercise 3. Define the function of the Gerund and translate.

1. Conducting heat and electricity is the property of most metals.
2. Heat may be produced by burning coal, gas or any other fuel.
3. Their having overheated the gas, changed the results of the experiment.
4. The rate of speeding up is commonly called «acceleration».
5. We know of the atomic reactor being fed with uranium 235.
6. The reactor's job is controlling the chain reaction.
7. We know of Yablochkov's having used the electric arc for lighting.
8. After having seen Lodygin's lamp, Edison took great interest in the invention.
9. Before starting the reaction one must provide for low pressure.
10. There are other ways of producing heat besides that of combustion.
11. On separating the desired components the salts were acted upon by nitric acid.
12. The teacher insisted on the students carrying out the experiment on calculating the equivalent weight of calcium.
13. Our having changed the design of the electrode, helped us in avoiding many mistakes.
14. Some of the wet precipitates may be ignited without drying.

Exercise 4. Translate into Ukrainian paying attention to the Gerund and the Participle.

1. The process of overcoming the attractive forces between the molecules of a substance is called melting.
2. Adding heat to a substance will not always cause a rise of its temperature.
3. The fast moving molecules are able to escape from a liquid surface.
4. By increasing the pressure the substance can be obtained in a liquid state provided the change from a liquid to solid is accompanied by an expansion.
5. Having absorbed much heat aluminium when cooled can give up the same quantity of heat.
6. In the process of boiling heat is added to a liquid.
7. A solid body having been melted, the change of state took place at a definite temperature.
8. A liquid being cooled, its molecules lose energy.
9. We know of great changes being produced by changing the temperature.
10. Also outlined at that paper is the method of standardizing the hydrochloric acid solution.
11. Radium resembles barium in being precipitating as an insoluble sulfate.
12. We all know of sodium and potassium tarnishing rapidly in the air.
13. We know of Lebedev's having made the first synthetic rubber in the world.
14. Mendeleyev's having created the Periodic Table made it possible to predict then undiscovered elements.
15. Aniline is a colourless oily liquid which on standing becomes dark in colour.

Exercise 5. Translate into Ukrainian paying attention to the Gerund.

Many ways are known now for preparing silicon. One of them is heating silicon dioxide with magnesium $SiO_2 + 2Mg = Si + 2MgO$.

Reducing silicon dioxide with carbon in an electric furnace is an industrial method of obtaining silicon. There exists a difficulty in preventing silicon and carbon from reacting when carbide is formed. But by using this reaction it is possible to obtain the product containing up to 98 per cent of silicon.

Test yourself. Do you know the following words?

To exhibit, covalent, peculiar, to link, linkage, to regard, to introduce, to increase, an increase, straight, to saturate, saturated, unsaturated, to replace, replacement, to remove, series, to undergo, to add on, chain, by means of, a number of, owing to, to contain, to differ, additional products.

UNIT 10

INNOVATIONS IN CHEMISTRY

Exercise 1. What inventions associated with chemistry do you know?

Exercise 2. Match the following inventions with the names of great scientists.

A Boyle-Mariotte Law
B Valency theory
C The main law of thermochemistry ("the law of definite amount of heat")
D Molecular theory
E Periodic Law
F Thermal gas expansion law

(1) Avogadro _____ (2) Boyle _____ (3) Gay-Lussac _____
(4) Mendeleyev _____ (5) Hess _____ (6) Kekule _____

Exercise 3. Choose one invention for presenting within a group.

Exercise 4. Take a look at the title of the text and say what it is about. Then read the text to check your guesses.

Exercise 5. What field does this innovation refer to?

SUNBURN DETECTION IS HOT WORK

UK scientists have developed UV-sensitive indicators that change colour when there is a danger of sunburn.

Over 70 000 people in the UK are diagnosed with skin cancer each year and sunburn is a contributing **factor**. The signs of sunburn can take four to eight hours to develop, by which time the skin is already damaged. While there are several UV **dosimeters** on the market, most are unable to distinguish between different skin types.

Also, they show a gradual colour change in response to sun exposure, which makes identifying the sunburn risk difficult. Andrew Mills and colleagues from the University of Strathclyde, Glasgow, have created what they claim is a 'simple, inexpensive, unambiguous sunburn **indicator**' that can be tuned to different skin types.

Mills' indicator uses a UV-driven acid-release agent coupled to a pH-indicating dye. Sunlight decomposes the acid-release agent leading to protonation of the dye, which causes a striking colour change. The length of time before the colour changes can be altered by using different **acid-release agents** or dyes, explains Mills, meaning that the indicator could be varied for use on all skin types.

As an alternative to this indicator, Mills has also made a blue indicator based on a tin oxide photocatalyst, which reduces a dye and becomes colourless on exposure to sunlight. 'The inorganic **pigment materials** match the way the skin absorbs UV **radiation**,' says Mills.

"It is the simplicity of the chemistry, and its ability to work on all skin types, that makes this research so **effective**," comments Peter Robertson, an expert in photocatalysis at the Robert Gordon University, Aberdeen, UK. He adds how "gratifying it is to see academic science coming up with a **solution** that is going to have an impact on society".

Mills says he is optimistic that these indicators will become commercially available but adds that the greatest challenge will be getting our sun-loving society to accept them.

Exercise 6. Look at the words in bold in the text above and write down their meanings.

Exercise 7. Fill in the correct word from the box. Use each word only once.

photocatalyst	*exposure*	*radiation*	*challenge*	*pigment*
agent	*factor*	*colour*	*skin*	*science*

1. contributing _____
2. _____cancer
3. sun _____
4. acid-release _____
5. _____change
6. a tin oxide _____
7. _____ materials
8. UV _____
9. academic _____
10. the greatest _____

Exercise 8. (a) Discuss advantages and disadvantages of the sunburn detection method. Is it really innovative?

(b) Give your ideas how to protect skin from UV radiation.

Exercise 9. What innovations in your University do you know? In pairs role play the interview.

EXERCISES AND ASSIGNMENTS

Exercise 1. Complete the table below with appropriate forms of the words.

verb	noun (thing)	noun (person)	adjective
develop			
	design		-
		inventor	
	innovation		
			productive
create			
	-	pioneer	
patent			

Exercise 2. The words below can be used to describe inventions or new ideas. Which have a positive meaning? Which have a negative meaning?

Efficient, brilliant, ingenious, revolutionary, ridiculous, viable, beneficial, ground-breaking, clever, uneconomical, impractical, useless, marketable, pointless, feasible.

positive	negative

Exercise 3. Read the text and fill in the blanks with words from the list below.

Ultraviolet, light, photochemistry, domestic, hydrogen, bugs, chemicals, sewage, germ-free, bug-killing.

PHOTOCHEMISTRY

Scientists have found new ways to shed light on the old problem of pollution – by using **1**_____ lamps to eradicate bacteria.

They have discovered that if sewage or other effluent is mixed with titanium dioxide, the basic ingredient of paint, and then exposed to ultra-violet **2** _____, the result is annihilation of all **3** _____.

This startlingly simple and cheap technique was revealed at last month's British Association for the Advancement of Science meeting in Swansea when researchers outlined their latest discoveries in the rapidly expanding field of **4** _____, the study of compounds that react to light.

The ultraviolet project, a spin-off from research aimed at producing **5** _____ fuel from sea water, has widespread applications. For example, simple, yet highly effective devices for removing legionella bacteria from office air conditioning systems could be built this way, said Dr Andrew Mills of Swansea University. In addition, pilot **6** _____ plants that use ultraviolet light are already being tested in America and Britain.

There are two parts to the **7** _____ system. Firstly, titanium dioxide is mixed in water. Then, when ultraviolet light is shone on the mixture, the titanium dioxide becomes energized and begins to oxidize chemicals it comes in contact with.

'Any bacteria that touch the granules are mineralized,' said Dr Mills, who presented the keynote Kelvin Lecture at the association meeting in Swansea. 'It is an extremely simple but powerful effect.'

The action produced is similar to that of household bleach, which one day could be replaced by ultraviolet light, he added.

'One idea is to use ultraviolet light to make the **8** _____ toilets of the future. The toilet would be coated in titanium dioxide and then an ultra-violet light would shine when the seat is put down, just as a fridge light comes on when its door is opened. Bacteria wouldn't have a chance.'

This last idea may seem a trifle eccentric. Nevertheless, several major companies, including Unilever, have recently begun research on ultraviolet-powered **9** _____ appliances, though most of this effort has concentrated on developing washing machines. Instead of using heat and detergents to break down and remove dirt on clothes, ultra-violet light would do the job.

Apart from saving on electricity, such devices would avoid the use of poisonous chemicals, like bleach, or detergents that have harmful environmental effects. 'That is the real motive of our research', added Dr Mills. 'Light-powered devices will free us from using damaging **10** _____, and also from having to generate electricity to provide heat – and that will have a considerable number of benefits, particularly for the environment.'

Exercise 4. Read the text about Alta Chemical. Translate into Ukrainian.

Technology and Innovation

Our success in innovation is primarily based in the close collaboration of our technicians, polymer chemists, and scientists in interdisciplinary project teams. Our R&D culture incorporates internal collaboration with production, sales and marketing but also external collaboration with research and industry partners. This carefully balanced working network is our quality base for acquiring, handling and generating new know-how in the form of *Basic Research*, *Material Science*, *Products*. In the past few years Alta Chemical developed a number of new technologies platforms which already have led to new products and still hold potential for further developments.

The latest technologies and facilities are successfully deployed to satisfy the specific needs of every individual customer. Make use of it and achieve commercial success.

Exercise 5. a) Work in groups of three. Make a list of at least five chemical products which are manufactured on a large scale.
b) Choose one from your list and try to explain to the others in your group how it is made using your own knowledge of the process.

Use the phrases
I think... happens next. You've forgotten about... What about... ?

Exercise 6. Use your search skills to find information about any inventions/innovations in chemical industry. Design a Power Point slide about it and prepare a short presentation "Innovations in chemical industry".

Exercise 7. Develop a report where you are going to describe the innovative idea you have found before in detail. You should put the following info in your report:

the field of using
the author of invention/innovation
the year of invention/innovation
details of birth of invention/innovation
how the invention/innovation is used/applied
your attitude/opinion to this invention/innovation

TEST YOURSELF

1) Give the Ukrainian equivalents:

Substance, property, oxygen, hydrogen, alkali, sodium, potassium, liquid, silicon, fluorine, chlorine, acid, density, mercury, barium, to treat, mixture, to oxidize, ether, copper, lead, to obtain, to apply, yield, to dissolve, film, solution,vapour.

2) What is the English for:

Натрій, кремній, луг, калій, щільність, фтор, розчин, водень, мідь, кисень, сіль, свинець, барій, рідина, окислювати, застосовувати, суміш, плівка, обробляти, пара, розчиняти, в результаті, давати, речовина, отримувати, ефір, ртуть, хлор, властивість.

3) Match the equivalents:

Розпадатися	hydrochloric acid
азотна кислота	to heat
окисляти (ся)	to freeze
об'єм	vapour
пара	volume
без кольору	colourless
без смаку	to dissolve
кипіти	to melt
замерзати	suitable
нагрівати	to decompose
розпад	stable
відповідний	treat
звичайний	tarnish
стійкий	to take fire
плавитися	to obtain
насичувати	to apply
загоратися	to absorb
обробляти	tasteless
отримувати	to saturate
темніти	to oxidize
застосовувати	ordinary
поглинати	decomposition
розчиняти	to boil

TEXTS FOR ADD' IONAL READING

LIQUIDS

The liquid state occupies an intermediate position between the gaseous and solid states, liquid having a definite volume but no definite shape.

Like a gas a liquid can take the shape of any vessel in which it is placed but in contrast to a gas a definite quantity of liquid is required for filling the vessel. A liquid cannot be compressed so much as a gas because its molecules are already situated closely, large pressure producing small changes in volume.

Increasing the temperature increases the kinetic energy of all the molecules. The kinetic energy of the molecules depends on the change of a liquid into the gaseous or solid states; the kinetic energy in turn is influenced by the temperature. Therefore there are definite temperature characteristics for most liquids at which these changes occur. They are known as transition temperatures.

If we place one liquid layer on top of a layer of a denser liquid in which it is soluble and put the vessel where it will not be disturbed, we shall see that two liquids begin gradually mixing. It is to be taken into consideration that all liquids do not flow with the same rate; water, alcohol, gasoline flowing easily; heavy oil, glycerine flowing very slowly.

When a liquid flows, layers of molecules begin rubbing over each other, friction being generated by this rubbing of layers of particles. The greater is the friction, the slower is the flow. A liquid which resists flowing results in a homogeneous solution. This example shows that the molecules of a liquid diffuse. They diffuse more slowly than those of a gas.

The molecules of a liquid have the greater relative strength of attraction, the density of liquids being much greater. Naturally, as the volume of a liquid begins changing with temperature, its density will also start changing with temperature.

POTASSIUM, K

Potassium is a silvery white metal which rapidly tarnishes when exposed to air. It is lighter than water, specific gravity being 0.86. It melts at 62.3°C and boils at 760°C. The chemical properties of potassium very closely resemble those of sodium but its reactions are more vigorous. When dropped on water the hydrogen evolved even from very small pieces of potassium takes fire brilliantly. Potassium has been made by heating potassium carbonate with charcoal. It can be obtained by electrolysis of the fused hydroxide or by using the fused chloride alone or mixed with calcium chloride.

SULPHUR DIOXIDE

Sulphur dioxide is a colourless gas with a smell of burning sulphur. It is twice as heavy as air. It cannot be collected over water since it is easily soluble. One volume of water at 0°C can dissolve 79.8 volumes of sulphur dioxide. The aqueous solution is strongly acid. The gas is readily liquefied. A pressure of 1.5 atmospheres is required for the condensation of the gas at 0°C, at -10°C the gas being liquefied under ordinary pressure. Liquid sulphur dioxide is a good solvent for phosphorous, iodine, resins, etc. Sulphur dioxide is decomposed at high temperature and by light. It combines with oxygen when heated, sulphur trioxide being formed. In the presence of moisture sulphur dioxide is a well-known reducing agent.

REACTIONS WITH OXYGEN

Oxygen is very reactive. When it combines with an element, the product formed is called an oxide. The process is called oxidation. There are only few elements not attacked by oxygen. We should mention inert gases among the elements unaffected by oxygen. Combinations with oxygen often liberate heat and light, this process being known as combustion. There are some elements which do not take fire unless heated. Some substances will ignite if very slightly heated. Other elements have to be heated to a high temperature before they take fire.

SILICON

Silicon does not occur free in nature. Its compounds make up 27.6% of the matter in the earth crust, this element being abundant. More methods for producing silicon are now known. One of them is heating silicon dioxide with magnesium. Industrially silicon may be obtained by reducing the dioxide (SiO_2) with carbon in an electric furnace. Silicon resembles carbon in having crystalline and amorphous form. They are alike in being very hard. Besides being employed in steel industry silicon and its compounds have a wide application in other branches of industry.

DECOMPOSITION REACTIONS OF WATER

Many elements decompose water at a suitable temperature. The alkali-earth metals and alkali metals attack water at the ordinary temperature. Magnesium is only slightly affected by cold water, but it reacts readily with hot water. Magnesium, zinc, iron react with steam. Aluminium doesn't react with water since it is protected by surface oxide film. But if this film is removed, aluminium will decompose water in the cold. Carbon, silicon, fluorine and chlorine combine with water. Carbon can be dissolved when passed into water, forming a green solution.

On standing it combines with water, giving hydrochloric acid. Fluorine acts in a similar way, forming hydrofluoric acid.

PROPERTIES OF HYDROGEN PEROXIDE

Pure hydrogen peroxide is a viscid liquid. It is colourless when viewed in thick layers. The liquid is odourless. Dilute aqueous solution has a bitter metallic taste. The liquid decomposes rapidly when heated at ordinary atmospheric pressure. It boils at 68-69°C under about 28 mm pressure. The liquid is soluble in water in all proportions. Pure hydrogen peroxide is stable. Dilute aqueous solutions may be kept for a year with no appreciable change. Alkaline solutions are not kept very well. Pure H_2O_2 is decomposed rapidly if any dust is present. Hydrogen peroxide possesses strong oxidizing properties It liberates iodine from solutions of potassium iodide. It converts lead sulfite into lead sulfate.

NITRIC ACID

Nitric acid is a colourless liquid, which fumes strongly in air. The pure acid rapidly absorbs moisture from the air. It mixes in proportions with water. It boils at 86°C and freezes to a white solid melting at –42°C. An aqueous solution containing 68% of nitric acid boils at 120.5°C. The concentrated solutions and the more dilute solutions, the lower their boiling points. Nitric acid is readily decomposed by heat. The main chemical properties can be classified as follows: it acts as an acid and as oxidizing and nitrating agent. It reacts with basic oxides, hydroxides and carbonates forming the corresponding salts. It is a powerful oxidizing agent. By means of nitric acid sulfur is oxidized to sulfuric acid and phosphorus to phosphoric acid. Many metallic sulfides are oxidized to sulfates. Nitric acid is used for the preparation of metallic oxides, oxyacids. It is an important reagent in organic chemistry. It is widely used in industry.

NITROGEN PENTOXIDE

Nitrogen pentoxide may be obtained when phosphorus pentoxide is added to pure, well cooled nitric acid. The temperature rises to 60-700 °C. The reaction symbolized:

$4\ HNO_3 + F_40_{10} = 2N_2O_5 + 4\ NPO_3$

Nitrogen pentoxide is produced by the action of ozone or nitrogen peroxide and by the action of chlorine on dry silver nitrate. Nitrogen pentoxide is manufactured in the form of white crystals. Its melting point is 30°C and above this point it decomposes. If nitrogen is rapidly heated, it explodes.

Nitrogen pentoxide reacts with water, yielding nitric acid, and hence it may be regarded as nitric anhydride.

It is indicated by means of analysis that its emperical formula is N_2O_5. The vapour density and the molecular weight have not been determined, hence the molecular formula is not known.

GREAT CHEMISTS

Roger Bacon

Roger Bacon was a friar living in 13th century England who, hundreds of years after his death became popularly known as a powerful sorcerer. He is most widely known among scholars as being one of the first people to use experimental methods in alchemy - the root of modern

chemistry - and is also known for his application of geometry to the science of lenses, and early experiments in gunpowder.

Roger Bacon was born in Ilchester in Somerset in the year 1214, it seems likely that he showed scholastic talent at an early age, his natural leaning in his younger years towards philosophy - especialy Greek philosophy of Aristotle. He also studied geometry, astronomy and mathematics. Roger moved to Paris around 1234, gaining a degree from the University of Paris around 1241, after which he started lecturing on the ideas and theories of Aristotle.

Roger returned to Oxford from Paris around 1247, from where his interest in the sciences developed further. He experimented with lenses as an aid to correcting human vision - one of his more famous associations - following in the footsteps of Robert Grosseteste (the bishop of Lincoln). His experiments relied on modern experimental observation and recording, and became exaggerated into supernatural feats later in the 16th century, when many popular books were published about his powers.

In Roger's day and age many of the sciences were interrelated with the beliefs of magic; alchemy is the root of modern chemistry and Roger was a practicing alchemist. As an alchemist he believed in the elixir of life and was probably involved in trying to create the philosophers stone. These practices and beliefs were not to endear him with his superiors in the Order of St Francis, and in that suspicious age the weight of heresy was bound to descend upon his shoulders.

He wrote his three-part work Opus Majus, (Great Work) Opus Minus (lesser work) and Opus Terilium (Third Work), writing each book in secret (because his superiors were opposed to his ideas) and finishing them in less than two years.

This was a remarkable achievement, denoting a drive and spark of genius that probably never had the chance to flame properly. The Opus Majus was the largest of the three and consisted of recourse on the experimental sciences and the common ground between philosophy, mathematics religion and other sciences. His experiments methods place him well above the shoulders of his contempories even if his ideas are now outdated. Like many writers slightly at odds with a given consensus his books stoked the fires of intolerance, and the last years of his life were spent in prison accused of promoting dangerous demonic ideas. It is surprising that he was not burned at the stake if these accusations were believed. This incarceration lasted from around 1277 to 1291, and one year after he was released he died in relative obscurity.

Maria Sklodowska-Curie

Maria Sklodowska was the daughter of Polish schoolteachers. She took work as a teacher after her father lost his savings through a bad investment. She also participated in the nationalist "free university," in which she read in Polish to women workers. She worked as a governess in Poland to support her older sister in Paris and eventually joined them there. She met and married Pierre Curie while she was studying science at the Sorbonne.

They studied radioactive materials, particularly the ore pitchblende. On December 26, 1898, the Curies announced the existence of an unknown radioactive substance found in pitchblende that was more radioactive than uranium. Over the course of several years, Marie and Pierre processed tons of pitchblende, progressively concentrating the radioactive substances and eventually isolating the chloride salts (radium chloride was isolated on April 20, 1902). They discovered two new chemical elements. "Polonium" was named for Curie's native country, Poland, and "radium" was named for its intense radioactivity.

In 1903, Pierre Curie, Marie Curie, and Henri Becquerel were awarded the Nobel Prize in Physics, "in recognition of the extraordinary services they have rendered by their joint researches

on the radiation phenomena discovered by Professor Henri Becquerel." This made Curie the first woman to be awarded a Nobel Prize.

In 1911 Marie Curie was awarded the Nobel Prize in Chemistry, "in recognition of her services to the advancement of chemistry by the discovery of the elements radium and polonium, by the isolation of radium and the study of the nature and compounds of this remarkable element".

Marie Curie died from aplastic anemia, almost certainly from unshielded exposure to hard radiation.

Adolf von Baeyer

Adolf von Baeyer (1835-1917), a German chemist, won the 1905 Nobel Prize in chemistry for his work on organic chemical structure and his contributions to the synthetic dye industry. Baeyer was the oldest of five children. His father, Johann Jacob Baeyer, a lieutenant general in the Prussian army, participated in a number of scientific programs aimed at measuring and investigating the shape of the earth, in which he collaborated with the government and directed by the astronomer Friedrich Wilhelm Bessel. Johann later became head of the Berlin Geodetic Institute.

As a pupil at the Friedrich-Wilhelms Gymnasium and at the University of Berlin, Baeyer concentrated on mathematics and physics. After completing a year of military service, in 1856, he transferred to the University of Heidelberg to study chemistry under Robert Wilhelm Bunsen. In 1872, he became a professor of chemistry at the newly created University of Strasbourg, and in 1875, became professor at the University of Munich. There he established an important chemical laboratory where many young chemists who achieved fame did their training.

In the early 1860's, Baeyer began research into uric acid, which led to his discovery of barbituric acid. Barbiturates became a major c' ss of drugs used to promote calmness and sleep. Baeyer then began research in dyes. In 1880 . .e devised a method for the synthesis of the dye indigo. The following year, the Royal Society of London awarded Baeyer the Davy medal for his work with indigo, which was accurate except for the stereochemical arrangement of the double bond, which was later modified. In 1883, he also determined the structure of indigo.

Baeyer is also known for his theory that helped explain why carbon rings of five or six atoms are much more common and stable than carbon rings with fewer or more atoms. This investigation of complex ring structures paved the way for later work in biochemistry.

Baeyer's other significant work includes the 1871 discovery of phenolphthalein (used as an indicator of alkalinity or acidity) and fluorescein (a powder used in dyes), and his subsequent discovery of the resin that results from the reaction between phenol and formaldehyde (which Leo Hendrik Baekeland later developed into Bakelite), and the first synthesis of a terpene in 1888.

In addition to being awarded the 1905 Nobel Prize in chemistry, that year, Baeyer was honored on his 70th birthday with a publication of his scientific papers.

Antoine-Laurent Lavoisier

The son of a wealthy Parisian lawyer, Antoine-Laurent Lavoisier (1743–1794) completed a law degree in accordance with family wishes. His real interest, however, was in science, which he pursued with passion while leading a full public life. On the basis of his earliest scientific

work, mostly in geology, he was elected in 1768 - at the early age of 25 - to the Academy of Sciences, France's most elite scientific society. In the same year he bought into the Ferme Générale, the private corporation that collected taxes for the Crown on a profit-and-loss basis.

In 1775 Lavoisier was appointed a commissioner of the Royal Gunpowder and Saltpeter Administration and took up residence in the Paris Arsenal. There he equipped a fine laboratory, which attracted young chemists from all over Europe to learn about the "Chemical Revolution" then in progress. He meanwhile succeeded in producing more and better gunpowder by increasing the supply and ensuring the purity of the constituents - saltpeter (potassium nitrate), sulfur, and charcoal - as well as by improving the methods of granulating the powder.

Characteristic of Lavoisier's chemistry was his systematic determination of the weights of reagents and products involved in chemical reactions, including the gaseous components, and his underlying belief that matter - identified by weight - would be conserved through any reaction (the law of conservation of mass). Among his contributions to chemistry associated with this method were the understanding of combustion and respiration as caused by chemical reactions with the part of the air (as discovered by Priestley) that he named "oxygen," and his definitive proof by composition and decomposition that water is made up of oxygen and hydrogen. His giving new names to substances - most of which are still used today - was an important means of forwarding the Chemical Revolution, because these terms expressed the theory behind them. In the case of oxygen, from the Greek meaning "acid-former," Lavoisier expressed his theory that oxygen was the acidifying principle. He considered 33 substances as elements - by his definition, substances that chemical analyses had failed to break down into simpler entities.

Alfred Nobel

In the 18th and early 19th centuries, the growing understanding of gases and the reactions that produce them was of great importance to modern industrial society. Not least was the production of explosives - substances that undergo reactions involving the release of heat and rapidly expanding gaseous products. In making black powder Antoine-Laurent Lavoisier and E. I. du Pont were improving a technology known to Western cultures since the 14th century and even earlier in China and the Far East. By the mid-19th century much more powerful explosives were being created by treating various organic substances with nitric acid. Among these new explosives was dynamite, a stabilized form of nitroglycerin, invented in 1867 by Alfred Nobel (1833–1896). One thousand times more powerful than black powder, it expedited the building of roads, tunnels, canals, and other construction projects worldwide.

Nobel's father, Immanuel, was a Swedish inventor-entrepreneur. When Alfred was still a young child, Immanuel relocated his business and family to St. Petersburg, Russia, where he supplied the Russian military with war materials, including early underwater mines. Alfred and his brothers were educated at home by Swedish and Russian tutors in chemistry and other subjects. Alfred became very proficient in chemistry but also entertained ambitions of becoming a writer. Partly to dissuade him from the latter, his father financed his 16-year-old son's travel and study in Europe, including a stay of some months in the Paris laboratory, where Nobel shared workspace with an Italian chemist, Ascanio Sobrero, who had first prepared nitroglycerin in 1846.

When he was 17, Nobel apprenticed in New York with the Swedish-American inventor John Ericsson. When he returned to St. Petersburg, the Nobel factory was booming thanks to the Crimean War. When the war ended and the firm went into bankruptcy, Nobel and his father turned to developing methods to produce nitroglycerin in quantity for use in construction. In

1862 he began its manufacture in a small plant outside Stockholm—a venture that cost the life of his youngest brother, Emil. Nobel persevered at developing a safe nitroglycerin explosive, first inventing the blasting cap and then discovering that a silicaceous earth, kieselguhr, would stabilize nitroglycerin, thus making dynamite.

Nobel became wealthy by setting up companies and selling patent rights to dynamite and related products worldwide. The DuPont Company in the United States became one of the chief companies associated with Nobel. In 1875 he created blasting gelatin, a colloidal suspension of nitrocellulose in glycerin, and in 1887 ballistite, a nearly smokeless powder especially suitable for propelling military projectiles. Nobel, the man who had tried to make handling explosives safe for workmen, was deeply troubled by the destructiveness of his inventions and became concerned with establishing worldwide peace.

Nobel died in 1896, leaving his considerable estate as an endowment for annual awards in chemistry, physics, medicine or physiology, literature, and peace - all of which represented his lifelong interests.

Carl Bosch

Carl Bosch was born at Cologne on August 27, 1874, and grew up there. From 1894 to 1896 he studied metallurgy and mechanical engineering at the Technische Hochschule in Charlottenburg, but started reading chemistry at Leipzig University in 1896. He graduated with a paper on organic chemistry in 1898. He entered the employ of the Badische Anilin- und Sodafabrik, Ludwigshafen, Rhine as a chemist in April 1899 and participated actively in the development of the then new industry of synthetic indigo. At the turn of the century Bosch became interested in the problem of the fixing of nitrogen and his first experiments in this field were done with metal cyanides and nitrides; in 1907 he started a pilot plant for the production of barium cyanide.

Bosch's opportunity for really large-scale work came when in 1908 the Badische Anilin- und Sodafabrik acquired the process of high-pressure synthesis of ammonia, which had been developed by Fritz Haber at the Technische Hochschule in Karlsruhe. Bosch was given the task of developing this process on a large industrial scale. This task involved the construction of plant and apparatus which would stand up to working at high gas pressure and high reaction temperatures. Haber's catalysts, osmium and uranium had to be replaced by a contact substance which would be both cheaper and more easily available. Bosch and his collaborators found the solution by using pure iron with certain additives. Further problems which had to be solved were the construction of safe high-pressurized blast furnaces, a cheap way of producing and cleaning the gases necessary for the synthesis of ammonia. Step by step Bosch went on to using increasingly larger manufacturing units and thus created the industry which deals with the production of synthetic ammonia according to the high-pressure process.

From this work resulted the second task of making the thus won ammonia available for use in industry and agriculture. Bosch succeeded in working out methods for the industrial production of nitrogen fertilizers, thus providing practically every country in the world with sufficient fertilizers for agricultural purposes. The Stickstoffwerke (Nitrogen works) in Oppau were opened in 1913, followed by the even larger Leunawerke near Merseburg in 1917, where the synthesis of methanol and the hydrogenation of oil were added to the production programme. Bosch was appointed Managing Director of the Badische Anilin- und Sodafabrik in 1919. In 1935 Bosch was appointed Chairman of the Board of Directors of the I.G. Farbenindustrie A.G.

Bosch was honoured in many ways and not only for his achievements and inventions in the field of industry, but also for his research in pure science, which he considered to be his duty. Bosch particularly enjoyed his membership of various German and foreign scientific academies, and his chairmanship of the Kaiser Wilhelm Society of which he became its President in 1937.

He died after a prolonged illness on April 26, 1940.

Henri Moissan

Henri Moissan was born in Paris on September 28, 1852. His advanced education began in the Collège de Meaux. A year later, he directed a small laboratory of his own before joining Debray and Troost in the laboratories of the Sorbonne. He was appointed to a junior position in the Agronomic Institute in 1879 and he gained his doctoral degree in 1880 with a thesis on the cyanogen series. He became assistant lecturer and senior demonstrator at the School of Pharmacy and in 1886 he was elected Professor of Toxicology. In 1899 he took the Chair of Inorganic Chemistry and in 1900 he was appointed Assessor to the Director of that School. In the same year, he succeeded Troost as Professor of Inorganic Chemistry, University of Paris.

Moissan's first researches concerned the interchange of oxygen and carbon dioxide in the leaves of plants. He was soon to leave biology for the field of inorganic chemistry, where his early work was on the oxides of iron-group metals and chromium and a study of the chromous salts. In 1884 he turned his attention to fluorine chemistry, preparing some organic and phosphorus derivatives of that element. The following year he discovered that solutions of potassium fluoride in hydrogen fluoride at certain strengths remained liquid and conducted electrolytically at sub-zero temperatures: a year later he successfully electrolysed these solutions to isolate fluorine for the first time. He made a full study of the properties of the gas and its reactions with other elements.

In 1892, Moissan theorized that diamonds could be synthesized by crystallizing carbon under pressure from molten iron. He designed and developed the electric-arc furnace, attaining temperatures up to 3,500°C, to assist him in work which led to the production of tiny artificial stones. He subsequently used the furnace to volatilize many substances which had been regarded as infusible and to prepare many new compounds, particularly carbides, silicides and borides; in 1891 he discovered carborundum. His close study of the carbides and their reaction with water led to his theory that, in some cases, petroleum may be formed by subterraneous reaction between certain carbides and water. He prepared the hydrides of calcium, sodium and potassium and showed them to be non-conductive and, using the electric furnace, isolated many metals.

Institute of Organic Chemistry of the National Academy of Sciences of Ukraine

Institute of Organic Chemistry of the NAS of Ukraine is one of the leading research institutions in the National Academy of Sciences of Ukraine. Its foundation is connected with the scientific schools of outstanding Ukrainian chemists, such as S.M. Reformatskii in Kyiv University and Academician V.G. Shaposhnikov in Kyiv Polytechnical Institute. The Institute of Organic Chemistry of the NAS of Ukraine has passed through hard times of the World War II, post-war years of tireless work for reconstruction and creative formation of the last decades.

The scientists of the Institute made an important contribution to the world science. Investigations of our scientists in the field of color of organic compounds theory, mechanisms of organic reactions, chemistry of heterocyclic compounds, chemistry of phosphorus-, fluorine-, and sulfur-organic compounds, chemistry of biologically active compounds, supramolecular

chemistry have deserved public recognition all over the world.

A.I. Kiprianov has discovered a phenomenon of chromophores reaction in complex organic dyes, theoretical grounds of this discovery allowed to build a modern mathematic model of conjugated linear systems and foresee the color of the compounds. A conception of multi-center cyclic transient states by E.O. Shilov played an outstanding part in the development of the modern ideas about mechanisms of organic reactions. Discovery of phosphaso-reactions by O.V. Kirsanov stimulated rapid development of new directions in chemistry of organo-phosphorus compounds. The principle of super strong acids construction proposed by L.M.Yagupolskii opened a new page in fluorine organic chemistry. The scientists of the Institute have elaborated a series of new organic materials with different functions. These materials are widely used in chemical industry and hydrometallurgy, agriculture, medicine and veterinary.

Several Institutes of chemical profile have been created on the basis of the scientific subdivisions of the Institute, they are: the Institute of High-Molecular Compounds Chemistry of the NAS of Ukraine, O.V. Bogatskii Physical-Chemical Institute of the NAS of Ukraine, Bio Petroleum Chemistry Institute of the NAS of Ukraine.

The priority direction of the modern research in the Institute is supramolecular chemistry. The works in the field of supramolecular chemistry are conducted under guidance of the Corresponding Member of the NAS of Ukraine V.I. Kalchenko, these works are directed to the molecular design, synthesis and study of macrocyclic compounds supramolecular interactions.

A large number of the elaborations of the Institute have been introduced to medicine, veterinary, national economy. The State highly appreciated the achievements of the Institute's scientists and awarded them with decorations and premiums. The staff is proud of the Institute's history and its creators who founded and built the Institute, defended the Country during the war years, prepared scientific brainpower, strengthened economy of the State, enriched the world science.

Навчальне видання

The World of Chemistry

АНГЛІЙСЬКА МОВА ЗА ПРОФЕСІЙНИМ СПРЯМУВАННЯМ
ДЛЯ СТУДЕНТІВ ПРИРОДНИЧИХ СПЕЦІАЛЬНОСТЕЙ

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