

МІНІСТЕРСТВО ОСВІТИ І НАУКИ,
МОЛОДІ ТА СПОРТУ УКРАЇНИ
Національний авіаційний університет

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**PROFESSIONAL ENGLISH:
CHEMICAL TECHNOLOGIES**

*Рекомендовано Міністерством освіти і науки,
молоді та спорту України як навчальний посібник для студентів вищих навчальних закладів*

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Навчальний посібник містить професійно орієнтовані текстові матеріали з хімічних технологій, нафти та нафтопродуктів, наукового та професійного спілкування, відповідні лексичні та граматичні вправи, і списки термінів згідно з навчальною програмою.

Для студентів I-IV курсів напрям "Хімічна технологія".

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ПЕРЕДМОВА

Навчальні та робочі-навчальні програми з іноземної мови та іноземної мови (за професійним спрямуванням) передбачають вивчення студентами всіх чотирьох курсів напряму "Хімічна технологія" тем, що включені до змісту навчального посібника, а саме: "Освіта. Історія хімії", "Періодична таблиця", "Матерія та її класифікація", "Хімічні реакції та рівняння", "Органічна хімія", "Аналітична хімія", "Нафта та її властивості", "Основні нафтопереробні процеси", "Авіаційні палива", "Наукова мова".

Основна мета навчального посібника – навчити майбутніх спеціалістів використовувати дану тематичну лексику в поєднанні із засвоєними знаннями граматики; розвинути стійкі навички читання, перекладу, анотування та реферування оригінальної літератури; навчити вибору та використанню інформації, необхідної в їхній майбутній професійній діяльності. Граматичні вправи побудовані на лексичному матеріалі уроку й охоплюють такі граматичні категорії: Indirect constructions, the Subjunctive Mood in Scientific English, Verb Tenses, Formal and Informal Styles of Writing.

Завдання допомагають контролювати вміння перекладати англомовний текст, перевіряти знання граматичних форм дієслова та визначати категорії часу, стану. Наявність списків термінів до кожного уроку допомагає студентам краще оволодіти лексичним матеріалом та дає змогу розширити словниковий запас.

Тематичний матеріал кожного модуля закріплюється системою вправ, які дозволяють працювати окремо з лексичними одиницями, зі словосполученнями, реченнями та загалом з текстом і які розподіляються за рівнем складності. Наукові та професійні тексти підібрані з урахуванням фаху студентів, і викладач має можливість вибирати потрібне.

Засвоєння лексичного та граматичного матеріалу допоможе студентові орієнтуватися в англомовній літературі згідно з запропонованими темами чотирьох курсів.

INTRODUCTION

We hope that students will find all the information given in the book stimulating, challenging and most of all, useful. It is designed to develop and extend the skills that students will use in their professional life. We also expect they will find the course useful in the range of communication tasks. Effective communication is important not only in our personal lives, but in professional as well.

The impact of chemistry cannot be overstated. Every single material thing in the universe is chemical, and the ability to understand and manipulate these chemicals is responsible for everything from modern food and drugs to plastics and computers.

Chemical engineers should possess many skills perfectly in line with the requirements of the specialty chemicals industry, especially within the process of technological development. One of the main tasks of this book is to provide students with necessary professional information and train them to use the acquired knowledge in the professional activities. A chemical engineer helps in defining new processes, improving established products and solving EHS (environment, health and safety) issues. Thus, the chemical engineer takes an active role in the main stages of a product life cycle and fosters through his communication skills cooperation with other colleagues working in different fields, such as production and engineering, product management, technical services.

That is why the book falls into ten main modules (according to the curriculum for four study courses) and contains the following themes: Education; The History of Chemistry; The History of Periodic Table; The Essence of Matter, its Properties, States and Classification; Chemical Reactions and Equations; Radiation and Nuclear Chemistry; Laboratory Experiments; Organic Chemistry; Analytical Chemistry; Monitoring of the Environment; Oil, its Properties and Classification; Main Oil Refinery Processes; Oil Products and their Uses; Aviation Fuels and Fueling System, etc.

Today the major role of chemistry in advanced technology lies also in new material research, study of electrochemical processes such as corrosion, finding cheaper processes of materials production, etc. To the scientific community, professionally based materials fulfill multiple purposes: they provide a common stopping ground to establish or maintain a "presence," and build relationships. Students feel the pressure to maximize both their scientific and professional connections. They are to reach two main goals. The first one is to cultivate relationships with other scientists. The second goal is to present

their research in the way that illustrates their competence. One goal can lead to the other.

Apart from professionally oriented information, one of the bookparts is dedicated to scientific communication. Knowledge of communication and mediation skills and positive presentation of yourself all are necessary for academic success.

Thus, the effective professional communication is trained via multiple communicative tasks of creative character present in each unit. Being able to communicate effectively is therefore essential if students want to build a successful career in their professional sphere. This sphere blends together professionally valid information, technology, and software to improve communication in a variety of settings ranging from technical writing to usability and digital media design.

Successful communication skills are critical to future chemical technologists, so they involve the following: writing, reading, editing, speaking, listening, software applications, computer graphics, and Internet research. Thus, graduates with professional communication backgrounds are more likely to bring to the organization sophisticated perspectives on society, culture, science, and technology.

This book provides some useful tips to help students to acquire the essential professional knowledge and communication skills that will improve their career prospects.

MODULE ONE
UNIT ONE
EDUCATION IN UKRAINE
THE NATIONAL AVIATION UNIVERSITY

Exercise 1. *Learn the following words and word combinations:*

well-known scientist – відомий вчений
state figure – державний діяч
airline – авіакомпанія
design bureau – конструкторське бюро
electrical engineering – електротехніка
material science – матеріалознавство
computer science – інформатика
to take pride in smth – пишатися
graduate – випускник
to emerge – виникати, з'являтися
designer – конструктор
corresponding member – член-кореспондент
unique device – унікальний пристрій
control system – система керування
to make a considerable contribution to smth – робити значний внесок
scientific and academic activities – наукова та навчальна діяльність
power – енергетика
the humanities – гуманітарні дисципліни
ecological safety – захист довкілля
extramural training – заочне навчання
subdivision – підрозділ
preparatory department – підготовче відділення
research institute – науково-дослідний інститут
training (educational) process – навчальний процес
state prize – державна премія
flight simulator – авіатренажер
on-board system – бортова система
hangar – ангар
profound knowledge – глибокі знання
amateur art activities – художня самодіяльність
hang-gliding – дельтапланеризм
to be in favour – користуватися успіхом

Exercise 2. Make a “map” of your knowledge about The National Aviation University. Answer the questions: 1) the history of the University; 2) the number of students and teaching staff; 3) the institutes the University includes; 4) modern facilities the University has; 5) the institute I study in.

Exercise 3. Read and translate the text.

The National Aviation University

The National Aviation University is a powerful aviation higher educational institution that is well-known not only in Ukraine, but also far abroad. Thousands of its scientists and lecturers, hundred thousands of graduates have made a considerable contribution to the development of national and world science, techniques and industry. More than 10,000 students study at the National Aviation University today, among them 1200 foreign students from more than 50 countries. The University trains not engineering specialists only, but economists, lawyers, environmentalists, translators, psychologists, sociologists as well.

The university dates back to August 1933, when the Aviation Faculty separated from Kyiv Polytechnical Institute and Kyiv Institute of Civil Air Fleet emerged. Since its founding, the National Aviation University has trained thousands of experts who work in Ukraine and almost 90 countries around the world. It became the leading institution for training specialists in civil aviation. Some of the alumni are notable industry organizers, well-known scientists, state and military figures. They head educational institutions, airlines, design bureaus, factories, organizations and services within different departments. The university has powerful scientific schools in the fields of mechanics, management, electronics, materials science, electrical engineering, computer science and computer facilities. The university takes pride in its graduates, who include the well-known scientist and designer of space-rocket systems V. Chelomey, a twice Hero of Socialist Labour, professor T. Bashta, academicians O. Kukhtenko and G. Pukhov, corresponding members of the Academy of Sciences O. Penkov and B. Malynovsky, professors A. Hrokholsky and L. Ilnytsky and others. At present the university is led by N. Kulick, a Doctor of Engineering Sciences, a Professor.

The University has joined the Bologna Convention that makes it possible for students to get diplomas of international standard and improve students' mobility. The university professors and students collaborate internationally with universities in Spain, Great Britain, Germany, the Netherlands, France, South Korea and other countries. The University also cooperates with the International Civil Aviation Organization (ICAO).

The University consists of 16 institutes, 2 separate faculties, 3 lyceums, 6 colleges and 12 research institutes including their subdivisions and 8 departments. There are the following institutes: Information-diagnostic Systems Institute; Aerospace Institute; Electronics and Control Systems Institute; Institute of Computer Technologies; Institute of Ecological Safety; Management and Economics Institute; Legal Institute "Institute of Air and Space Law"; Preparatory Institute; Humanities Institute; ICAO Institute; The Institute of Extramural and Distance Education; Institute of Innovative Technologies; Institute of Continuing Education; Institute of Management Technologies; Institute of International Relations.

Academic activities are performed by a highly skilled scientific and pedagogical team, including 23 academicians, corresponding members of the Academy of Science of Ukraine, 280 doctors of sciences, professors, 830 candidates of sciences and senior lecturers, 54 honored people in science and engineering of Ukraine and winners of State prizes.

The area occupied by the university is about 72 hectares. 45 planes and helicopters, 42 aviation engines, 3 complex flight simulators, 240 on-board systems, modeling stands and about 1600 modern computers are used in the training process. The scientific and technical library has about 2.5 million books.

The National Aviation University, the only one in Ukraine, has a unique hangar, radio equipment, a training aerodrome with aviation ground handling equipment, an aerodynamic training complex equipped with a wind tunnel, and the State Museum of Aviation. Students of the university also have access to the Sports Complex, the Arts and Culture Centre, the Medical Centre, accommodation in one among 11 hostels, a cafeteria with a seating capacity for 1000 people at a time, memberships in the Billiard Club and e-club, all located within the students' campus.

The life of our students is very interesting. Profound knowledge obtained during lectures and practical training gives them the opportunity to participate in scientific conferences and competitions where they show excellent results. Many students receive rector's grants and other prizes as awards for their achievements in studies and active participation in the social life of the university.

The university emphasizes the role of amateur art activities in organizing students' leisure. Yachting, aircraft modeling, and hang-gliding clubs are in great favour with the university staff and students.

The motto of the National Aviation University is: *Vivere! Vincere! Creare!* – Live! Win! Create!

Exercise 4. *Answer the following questions.*

1. When was the university founded? 2. What kind of specialists has it been training since its foundation? 3. What powerful scientific schools have been founded at the university? 4. Who is the present rector? 5. How many and what institutes train specialists at present? 6. What faculties do they have? 7. What other educational institutions are incorporated in the university? 8. How many students study at the university now? 9. What is the university teaching staff known for? 10. What facilities are used in the training process at the university? 11. What international centres have been opened at the university? 12. What kinds of activities are students engaged in at the university?

Exercise 5. *State whether the following sentences are true or false. Correct the false ones.*

1. Scientific and pedagogical schools established at the university make it possible to train not only engineering specialists, but agronomists, doctors, actors, TV and radio anchormen. 2. The university dates back to April 1933, when the Aviation Faculty separated from Kyiv Higher Military School of Aviation Engineers. 3. The scientific and technical library has about 2.5 million books. 4. Originally the university was called Kyiv Institute of Civil Air Fleet.

Exercise 6. *Complete the sentences.*

1. The University dates back 2. They head aircraft companies, ... 3. The University takes pride in 4. Teaching is carried out by 5. The area occupied by the University is 6. The scientific and technical library 7. The life of our students... .

Exercise 7. *Make up sentences putting the words in the correct order.*

1. was/ in/ 1933/ the University/ August/ founded
2. companies/ they/ design bureaus/ educational institutions/ and/ aircraft/ organizations/ head/ factories
3. the University/ pride/ its/ graduates/ in/ takes
4. scientific and pedagogical/ teaching/ carried out/ a highly skilled/ is/ by/ team
5. the University/ the ICAO/ contact/ established/ early '80/ in/ with
6. receive/ in studies/ their outstanding achievements/ many students/ rector's grants/ for/ as awards/ other prizes/ and

Exercise 8. *Translate into English.*

1. Десятки тисяч спеціалістів, які працюють в Україні і понад сто зарубіжних країн, пройшли підготовку в Національному Авіаційному Університеті. 2. Серед них є відомі вчені, керівники промисловості, державні та військові діячі. 3. Багато випускників НАУ продовжують працювати в рідному університеті, примножуючи його славу. 4. До навчального процесу в університеті залучаються провідні фахівці авіакомпаній та промислових підприємств. 5. Професорсько-викладацький склад налічує 18 лауреатів державних премій та 17 заслужених працівників науки і техніки України. 6. Університет надає великого значення ролі художньої самодіяльності в організації студентського дозвілля. 7. Традиційна щорічна «Студентська весна» стала справжнім фестивалем студентського мистецтва. 8. Університет надає всім охочим (provides all those willing) можливість підготуватися до вступу до Інституту довузівської підготовки.

Exercise 9. Make up as many questions to the following sentences as possible

1. Now graduates of the National Aviation University head airlines, factories, design bureaus, and educational institutions. 2. Leading experts of airlines and industrial enterprises are involved in the training process. 3. The university's sports centre provides excellent opportunities for sports activities. 4. All the teams of our university in various kinds of sports participate actively in city and national competitions.

Exercise 10. Read and translate the text.

ICAO Training Centre

The University established contact with the ICAO in the early '80s when the international organization held a number of seminars and meetings at the University. The University has participated in the implementation of many ICAO programmes aimed at expert's training, military pilots' re-training, scientific research etc.

Taking into account the high international recognition of the University, the ICAO Council took the decision to open the European Regional Aviation Security Training Centre at the University in 1996. The Centre received the International Certificate, which gives the ability to train all categories personnel of aviation companies and airports in the field of aviation security. The ICAO European Regional Aviation Security Training Centre works in co-operation with the Civil Aviation Administration of Ukraine, the International Civil Aviation Organization Headquarters.

In May 2001 the ICAO European Regional Government Safety Inspectors' Training centre was also opened at NAU. Both Centers are operated using a common methodology, using documents and materials developed by the ICAO.

Exercise 11. *Make a presentation on the following topic:*

Why does the University establish contacts with many international organizations?

Exercise 12. *Translate into English using active vocabulary.*

1. Перші контакти Національного авіаційного університету з ІКАО розпочались у 80-х роках. 2. Програма ІКАО охоплює такі напрями, як навчання спеціалістів, перепідготовка військових пілотів, розробка та переклад матеріалів ІКАО. 3. Європейський регіональний навчальний центр ІКАО з авіаційної безпеки відкрився у 1996 році. 4. Центр отримав міжнародний сертифікат на право навчання всіх категорій працівників авіаційних підприємств з авіаційної безпеки. 5. Для координації підготовки та перепідготовки спеціалістів у сфері безпеки авіації у 2001 році створено Інститут ІКАО.

Exercise 13. *Fill in the gaps with the following words and word combinations.*

*takes pride, head, design, exchange, 'Polit', August 1933,
leaders, state, foreign, experts, well-known, institutions, designer,
V.Chelomey, interesting*

The University dates back to _____. It has trained thousands of _____ who work in Ukraine and other countries of the world. Among them are _____ scientists, industry _____, military and _____ figures. They _____ aircraft companies, _____ bureaus, educational _____ and organizations. The University _____ in its graduates who include the well-known scientist and _____ of space-rocket system, _____. More than 500 _____ students are currently receiving higher education at the University. Students _____ between NAU and universities in Germany and China is increasing. The life of the students is _____. The University has its own KVN team, dance ensemble _____, students' amateur theatre.

Exercise 14. *Read the information about the institute you've chosen and advertise it for those willing to enter the institute.*

The Institute of Ecological Safety

The Institute of Ecological Safety was formed on the bases of the Faculty of Ecological Safety during its reorganization in 2010. Soon it became one of the leading institutes of the university providing training for more than 1100 students. The institute laboratories are equipped with hi-fi technologies providing great possibilities for scientific research.

The Institute of Ecological Safety contains six main departments. The team of teachers includes about 50 professors, doctors of science and 90 candidates of science. The Institute is led by O.I. Zaporozhec, a Doctor of Engineering Sciences, a Professor. Students are pursuing their degrees in 7 majors.

Students study four fields. The first of them is Chemical technology and engineering (majors: Chemical technology of fuels and carbon materials; Chemical technology of polymers). Oil and its products are very important as the main resources for energetic safety of any society, both today and in the future. Chemistry is the basic science; it has close ties with many different branches of industry. The producing of every material good is not possible without knowing chemical processes. Discovering new methods for producing polymers and on their base creating new polymer materials and compositional polymer materials together with precise working out their technology is one of the goals of modern chemical engineering. So, graduating in this field, students become real specialists in all these urgent problems and solve them with great and significant results.

The second field is Biotechnology (majors: Ecological biotechnology; Biotechnology of biologically active substances). Modern biotechnology helps a lot in providing the humanity with food, medicines, and the means for fighting the harmful consequences of transformation of environment.

The third one is Ecology (major: Ecology, environment protection and balanced nature resource management). Active human activity has become a reason for transformation of environment. Today the changes in nature have gained the status of those threatening the future existence of the mankind and assisting by many ecological crises. The experts of this field have enough knowledge to solve these problems.

The fourth field is Geodesy and Land-use system (majors: Organization of land exploitation and cadastre, Geoinformational systems and technologies). The students are concerned with the physical, chemical, and biological processes that govern natural and agricultural ecosystems. Graduates qualify for effective soil and land management.

Exercise 15. *Work in pairs and make up a dialogue on the topic: 'I am a student of the Institute of Ecological Safety using the following words and word combinations.*

1st-year student/ freshman	: expelled from the University
2nd-year student	eat
full-time student	disrupted classes
part-time student	not
inaugural ceremony	rotter
audience hall	miss classes
student identity card	skip/ go skiing
weekend classes	never
attendance is compulsory	: late for classes
check students' coming in time	take exams
: given a good talking	miss exams

Exercise 16. *Imagine that you are a member of the international educational organization. Your task is to advertize the National Aviation University to the students from different countries. Work in pairs and make a short concise presentation on the topic.*

Exercise 17. *Put the paragraphs in the right order. Give the title to the text. Add more information on the topic.*

(A) Education in Ukraine is given a great attention by the government and a large number of facilities and institutions exist for the purpose of educating the population. The system of education in Ukraine extends right from pre-school to higher education.

(B) Basic school also falls under the secondary education system in Ukraine. This is the students' last level of formal basic education. This level of education provides the link to continuous education systems. It is compulsory to attend basic school for five years. Formal basic education is completed between the ages of 14 and 16 years. On completion of basic schooling the student will receive a certificate allowing them to continue on to upper secondary school as well as certain higher education institutions.

(C) Ukraine has a very well-developed higher education system. Higher education is provided by higher education establishments, private bodies and scientific and methodological facilities of the government. This system also encompasses post-graduate programs and Ph.D's as well as self-education. The levels of accreditation depend on the Higher Education Institutes' status.

(D) Ukraine's educational legislation places great importance on pre-school education. This early form of education is to be cared for by the family

or through a pre-school institution. A variety of institutions is available for this level of education in Ukraine and includes day care centers, kindergartens and special facilities for disabled children. Provision is also made for orphans.

(E) Level one includes vocational schools that train junior specialists. Level two are colleges and similar organizations that teach bachelors. Level three is made up of universities, institutes, academies and conservatories which provide education for bachelors and specialists. Level four includes universities, conservatories, institutes and academies which educate bachelors, specialists and masters.

(F) It is evident that the system of education in Ukraine has been well-developed and opportunities exist for the entire population, even those living in the rural areas.

(G) Elementary school education in Ukraine forms the foundation of a child's schooling career. Ukraine's Law on Education states that provision of elementary schools must be made wherever there are students. Elementary or primary education acts to develop children's personalities, talents, formation of morals, working education as well as knowledge of the human body, nature, industry and society. This level of education is compulsory in Ukraine and is available at various types of institutions. Students begin secondary comprehensive schooling at the age of 6 or 7 years.

Exercise 18. *Develop the ideas.*

1. Elementary school education in Ukraine forms the foundation of a child's schooling career.
2. Ukraine has a very well-developed higher education system.
3. Ukraine is one of the best platforms for education, business and tourism.
4. In today's world the urge to take admissions in Medical and Engineering Universities and Colleges is getting high among the students.
5. Higher education within the Ukrainian community has always been open to foreign students.
6. The National Academy of sciences, higher educational institutions of Ukraine maintain broad international contacts.
7. Ukraine is distinguished by a high level scientific potential.
8. The Ukrainian educational system is organised into five levels: preschool, primary, secondary, higher and postgraduate education

UNIT TWO HISTORY OF THE PERIODIC TABLE

Exercise 1. *Learn the following words and word combinations:*

to establish the atomic theory of matter –
 започаткувати атомістичну теорію матерії
 relative weights of atoms – відносна вага атомів
 to be periodic function – бути в періодичній залежності
 previous attempt – попередня спроба
 vacant place – вакантне місце
 decade – десятиліття
 great breakthrough – великий прорив (відкриття)
 respectively – відповідно
 to be arranged according to atomic weight –
 бути розміщеним відповідно до атомної маси
 gaps for elements – вільні місця для елементів
 to undergo – зазнавати
 principal elaboration – принципове вдосконалення
 to extend the law – розширювати закон
 to suspect – підозрювати
 to comprise – охоплювати
 in terms of – з точки зору
 key to the success – ключ до успіху
 effort – зусилля
 realization – усвідомлення
 improved version of the periodic table –
 удосконалена версія періодичної таблиці

Exercise 2. *Read and translate the text.*

History of the Periodic Table

As a result of discoveries that firmly established the atomic theory of matter in the first quarter of the 19th century, scientists could determine the relative weights of atoms of the known elements. The chemical law that the properties of all the elements are periodic functions of their atomic weights was developed independently by two chemists, in 1869 by the Russian Dmitry Mendeleev and in 1870 by the German Julius Lothar Meyer. The key to the success of their efforts was the realization that previous attempts had failed because a number of elements were as yet undiscovered and that vacant places



must be left for such elements in the classification.

For many decades, the list of known chemical elements had been steadily increasing. A great breakthrough in making sense of this long list was Dmitry Mendeleev's development of the periodic table, and particularly Mendeleev's use of it to predict the existence and the properties of germanium, gallium, and scandium, which he called ekasilicon, ekaaluminium, and ekaboron respectively. Mendeleev made his prediction in 1870. This table displays a periodicity in the elements' properties when they are arranged according to atomic weight.

Working as a Professor of General Chemistry at the University of St. Petersburg and writing two-volume Principles of Chemistry Mendeleev tried to classify the elements according to their chemical properties. In 1869 he published his first version of what became known as the periodic table. In 1871 he published an improved version of the periodic table, in which he left gaps for elements that were not yet known.

The periodic law has undergone two principal elaborations since its original formulation by Mendeleev and Meyer. The first revision involved extending the law to include a whole new family of elements, the existence of which was completely unsuspected in the 19th century. This group comprised the first three of the noble, or inert, gases argon, helium, and neon, discovered in the atmosphere between 1894 and 1898 by the British physicist John William Strutt, and the British chemist Sir William Ramsay. The second development in the periodic law was the interpretation of the cause of the periodicity of the elements in terms of the Bohr's Theory (1913) of the electronic structure of the atom.

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	H																		
He	Li	Be	B	C	N	O	F												
Ne	Na	Mg	Al	Si	P	S	Cl												
Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni									
		Cu	Zn	Ga	Ge	As	Se	Br											
Kr	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd									
		Ag	Cd	In	Sn	Sb	Te	I											
Xe	Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt									
		Au	Hg	Tl	Pb	Bi	Po	At											
Rn	Fr	Ra	Ac	Th	Pa	U													

Dobereiner's triads
 Known to Mendeleev
 Unknown to Mendeleev

Exercise 3. *Answer the following questions.*

1. Why could scientists determine the relative weights of atoms of the known elements? 2. What does the periodic law state? 3. Who and when developed the periodic law? 4. Why had the previous attempts to classify the known elements failed? 5. Who made a great breakthrough in making sense of the long list of elements? 6. What did Mendeleev predict? 7. What elements were first called ekasilicon, ekaaluminium, and ekaboron? 8. What does the periodic table display? 9. Due to what events did the periodic table undergo two principal elaborations?

Exercise 4. *Say whether the given sentences are true or false.*

1. The chemical law states the properties of all the elements are periodic functions of their atomic weights. 2. The periodic table was developed only in 1869 by the Russian Dmitry Mendeleev. 3. For many decades, the list of known chemical elements had been steadily decreasing. 4. Mendeleev used the periodic table to predict the existence and the properties of germanium, gallium, and sodium. 5. Mendeleev tried to classify the elements according to their chemical properties. 6. The first development in the periodic law was the interpretation of the cause of the periodicity of the elements in terms of the Bohr's Theory.

Exercise 5. *Match the terms with their definitions. Memorise them.*

<i>Period</i>	Elements in a horizontal row of the periodic table.
<i>Periodicity</i>	When the elements are arranged by atomic number, their physical and chemical properties vary periodically. The properties of the elements are periodic functions of their atomic numbers.
<i>Periodic law</i>	An arrangement of elements in an order of increasing atomic numbers that also emphasizes periodicity.
<i>Periodic table of elements</i>	With increasing atomic number, the electron configuration of the atoms displays a periodic variation.

Exercise 6. *Fill the chart with the missing words.*

Verb	Noun	Adjective	Adverb
To determine			
			independently
	success		
		increasing	
To publish			
	elaboration		

Exercise 7. *Find the words that go together.*

to establish	to display
to determine	to arrange
to leave	to classify
to increase	to undergo
to make	to extend
to predict	

The law, principal elaboration, the elements, according to atomic weight, the existence of elements, periodicity, list of known chemical elements, sense, vacant place, the relative weight of atom, the atomic theory.

Exercise 8. *Match the beginnings of the sentences with their endings.*

1) The horizontal form familiar to us soon replaced	a) according to increasing atomic mass.
2) Radiation, first discovered in 1898 by Henri Becquerel, was	b) the original vertical periodic table.
3) The blank spaces in Mendeleev's original vertical periodic table were	c) sodium, and eight elements later comes potassium.
4) The era of nuclear chemistry began	d) a by-product of naturally occurring transmutations of elements exchanging identities.
5) All of the new elements predicted by Moseley	e) lanthanum, as well as the lighter elements yttrium and scandium.
6) The "rare earth" elements are today recognized to include	f) predictions of new elements such as gallium and germanium.
7) The 8th element after lithium is	g) were found within the next 24 years.
8) In 1869, Mendeleev ordered the 63 then-known elements	h) in earnest in the late 1930s.

Exercise 9. *Translate the text into English; add additional information about Dmitry Mendeleev with is not reflected in the text.*

Дмитро Менделєєв народився у Сибіру, був останнім з чотирнадцяти дітей. Після смерті батька сім'я переїздить до Петербургу, де у кінці 1860-х років Д. Менделєєв почав працювати над своїм найбільшим досягненням – періодичною таблицею елементів. Розмістивши 63 відомі на той час елементи за їхньою атомною вагою, вченому вдалося згрупувати їх за подібними властивостями. Менделєєв передбачив існування нових елементів у тих місцях таблиці, де були порожні клітини. Ці елементи виявилися галій, скандій та германій.

Саме це забезпечило беззаперечне визнання його періодичної таблиці, як наріжного каменя науки хімії і

нашого розуміння всесвіту. Вчений змінив наше розуміння властивостей атомів і створив таблицю, яка побувала у шкільних класах хімії всього світу.

Exercise 10. *Retell the text **History of the Periodic Table** paying attention to the following key points:*

- The discoveries that firmly established the atomic theory;
- The chemical law of periodicity;
- The key to the success of Mendeleev's and Meyer's efforts;
- A great breakthrough in making sense of the elements list;
- Two principal elaborations of periodic law.

Exercise 11. *Work in pairs and make the list of everything you know about chemical element as a substance. Pay special attention to the following points:*

- its structure;*
- its place in periodic table;*
- element's atomic number;*
- all elements' arrangement in the periodic table.*

Chemical Element

The concept of chemical element is related to chemical substance. A chemical element is specifically a substance which is composed of a single type of atom. A chemical element is characterized by a particular number of protons in the nuclei of its atoms. This number is known as the atomic number of the element. For example, all atoms with 6 protons in their nuclei are atoms of the chemical element carbon, and all atoms with 92 protons in their nuclei are atoms of the element uranium. Ninety four different chemical elements or types of atoms based on the number of protons exist naturally. A further 18 have been recognised by IUPAC (the International Union of Pure and Applied Chemistry) as existing artificially only. Although all the nuclei of all atoms belonging to one element will have the same number of protons, they may not necessarily have the same number of neutrons; such atoms are termed isotopes. The most convenient presentation of the chemical elements is in the periodic table of the chemical elements, which groups elements by atomic number. Due to its ingenious arrangement, groups, or columns, and periods, or rows, of elements in the table either share several chemical properties, or follow a certain trend in characteristics such as atomic radius, electronegativity, etc.

Exercise 12. *Read the names of the chemical elements, find their transcriptions, and memorise the spelling of each element.*

Nomenclature of substances is a critical part in the language of chemistry. Generally it refers to a system for naming chemical compounds. Earlier in the history of chemistry substances were given names by their discoverers, that often led to some confusion and difficulty. However, today the IUPAC system of chemical nomenclature allows chemists to specify by name specific compounds amongst the vast variety of possible chemicals. The standard nomenclature of chemical substances is set by the International Union of Pure and Applied Chemistry (IUPAC).

1 - H - Hydrogen	16 - S - Sulfur
2 - He - Helium	17 - Cl - Chlorine
3 - Li - Lithium	18 - Ar - Argon
4 - Be - Beryllium	19 - K - Potassium
5 - B - Boron	20 - Ca - Calcium
6 - C - Carbon	21 - Sc - Scandium
7 - N - Nitrogen	22 - Ti - Titanium
8 - O - Oxygen	23 - V - Vanadium
9 - F - Fluorine	24 - Cr - Chromium
10 - Ne - Neon	25 - Mn - Manganese
11 - Na - Sodium	26 - Fe - Iron
12 - Mg - Magnesium	27 - Co - Cobalt
13 - Al - Aluminium	28 - Ni - Nickel
14 - Si - Silicon	29 - Cu - Copper
15 - P - Phosphorus	30 - Zn - Zinc
31 - Ga - Gallium	75 - Re - Rhenium
32 - Ge - Germanium	76 - Os - Osmium
33 - As - Arsenic	77 - Ir - Iridium
34 - Se - Selenium	78 - Pt - Platinum
35 - Br - Bromine	79 - Au - Gold
36 - Kr - Krypton	80 - Hg - Mercury
37 - Rb - Rubidium	81 - Tl - Thallium
38 - Sr - Strontium	82 - Pb - Lead
39 - Y - Yttrium	83 - Bi - Bismuth
40 - Zr - Zirconium	84 - Po - Polonium
41 - Nb - Niobium	85 - At - Astatine
42 - Mo - Molybdenum	86 - Rn - Radon
43 - Tc - Technetium	87 - Fr - Francium
44 - Ru - Ruthenium	88 - Ra - Radium
45 - Rh - Rhodium	89 - Ac - Actinium
46 - Pd - Palladium	90 - Th - Thorium
47 - Ag - Silver	91 - Pa - Protactinium
48 - Cd - Cadmium	92 - U - Uranium

49 - In - Indium	93 - Np - Neptunium
50 - Sn - Tin	94 - Pu - Plutonium
51 - Sb - Antimony	95 - Am - Americium
52 - Te - Tellurium	96 - Cm - Curium
53 - I - Iodine	97 - Bk - Berkelium
54 - Xe - Xenon	98 - Cf - Californium
55 - Cs - Cesium	99 - Es - Einsteinium
56 - Ba - Barium	100 - Fm - Fermium
57 - La - Lanthanum	101 - Md - Mendeleevium
58 - Ce - Cerium	102 - No - Nobelium
59 - Pr - Praseodymium	103 - Lr - Lawrencium
60 - Nd - Neodymium	104 - Rf - Rutherfordium
61 - Pm - Promethium	105 - Db - Dubnium
62 - Sm - Samarium	106 - Sg - Seaborgium
63 - Eu - Europium	107 - Bh - Bohrium
64 - Gd - Gadolinium	108 - Hs - Hassium
65 - Tb - Terbium	109 - Mt - Meitnerium
66 - Dy - Dysprosium	110 - Ds - Darmstadtium
67 - Ho - Holmium	111 - Rg - Roentgenium
68 - Er - Erbium	112 - Cn - Copernicium
69 - Tm - Thulium	113 - Uut - Ununtrium
70 - Yb - Ytterbium	114 - Uuq – Ununquadium
71 - Lu - Lutetium	115 - Uup - Ununpentium
72 - Hf - Hafnium	116 - Uuh - Ununhexium
73 - Ta - Tantalum	117 - Uus - Ununseptium
74 - W - Tungsten	118 - Uuo – Ununoctium

Exercise 13. *Read the following elements.*

Si, P, Ar, K, Sc, Ti, Mn, Fe, Ni, N, O, F, Ne, Cu, Ge, As, Se, B.

Exercise 14. *Match the elements with their names.*

Am	Cr	La	P
Sb	Ga	W	Os
Cd	Au	Ta	N
B	He	Na	Ni
At	H	Ag	Hg
C	I	Si	Md
Es	Fe	Po	Pb

Hydrogen, iodine, iron, lanthanum, lead, carbon, chromium, einsteinium, gallium, gold, helium, phosphorus, polonium, mendeleevium, mercury, nickel, nitrogen, osmium, americium, antimony, astatine, boron, cadmium, silicon, silver, sodium, tantalum, tungsten.

Exercise 15. *Write the chemical symbols of the following elements.*

Hydrogen, Scandium, Nickel, Manganese, Arsenic, Zinc, Iron, Lithium, Vanadium, Sulfur, Chlorine, Argon, Aluminum, Silicon, Carbon, Nitrogen, Fluorine.

Exercise 16. *Translate the sentences into English.*

1. Перші хіміки намагалися розмістити елементи з точки зору зручності та практичного використання. 2. Спочатку хіміки розділили елементи на метали та неметали. 3. Коли кількість відомих елементів зростала, і вчені більше дізнавалися про них, їх спантеличення тільки збільшувалося. 4. Час від часу пропонувалися все нові нові способи класифікувати елементи. 5. Перші системи класифікації елементів були грубими та базувалися на атомних масах.

Exercise 17. *Match the word combinations to make the comparisons. Find the Ukrainian equivalents and explain which of them have chemical background and why. Use them in the sentences of your own.*

As brave as	a lead
As fat as	a lion
As heavy as	iron
As hard as	a pancake
As flat as	a new pin
As dry as	a pig
As clean as	a coal
As bright as	a bee
As black as	a button
As hairy as	a bone
As clear as	a gorilla
As busy as	crystal

Exercise 18. *Work in pairs and act out a dialogue between:*

a) *Dmitry Mendeleev and Julius Lothar Meyer;*

b) *Hydrogen and Nitrogen (a funny one);*

c) *Dmitry Mendeleev and a student of the National Aviation*

University.