МОРОЗ Л. В.,
ЯСНОГУРСЬКА Л. М.,
КОВАЛЮК В. В.
МІЧУДА Н. М.,
РОМАНЮК С. К.

АНГЛІЙСЬКА МОВА ДЛЯ ПРИРОДНИЧИХ НАУК

ENGLISH FOR NATURAL SCIENCES

МОРОЗ Л. В.,
ЯСНОГУРСЬКА Л. М.,
КОВАЛЮК В. В.
МІЧУДА Н. М.,
РОМАНЮК С. К.

АНГЛІЙСЬКА МОВА ДЛЯ ПРИРОДНИЧИХ НАУК

(ENGLISH FOR NATURAL SCIENCES)

Рівне

Видавець Ю. Кукса

2025

УДК 811.111 (075.8)
А-64

Затверджено на засіданні кафедри іноземних мов
Рівненського державного гуманітарного університету,
(протокол № 10 від 16 жовтня 2024 р.)

Рекомендовано до друку вченою радою
Рівненського державного гуманітарного університету
(протокол № 2 від 25 жовтня 2024 р.)

Рецензенти:

Л.Є. Купчик, кандидат педагогічних наук, доцент, завідувач кафедри іноземних мов Національного університету водного господарства та природокористування;

Т.В. Кучма, кандидат філологічних наук, доцент кафедри романно-германської філології Рівненського державного гуманітарного університету

Мороз Л. В., Ясногурська Л. М.,Ковалюк В.В., Мічуда Н.М., Романюк С.К. Англійська мова для природничих наук. Навчальний посібник — Рівне : Ю. Кукса. — 2025.—155 с.

ISBN 978-617-8672-04-1

Цей навчальний посібник знайомить з особливостями наукової та ділової мови, допомагає набути навичок та вмінь, необхідних у спілкуванні. Система граматичних та лексичних вправ сприяє ефективній підготовці до складання іспиту TOEFL.

Книга містить країнознавчу інформацію, зокрема про життя студентів та систему освіти англомовних країн.

Посібник призначений для студентів, аспірантів, викладачів факультетів природничих наук вищих навчальних закладів. Також може бути використаний на заняттях з науково-технічного перекладу у школах та ліцеях.

English for Natural Sciences is intended to familiarize students with specific features of scientific and business English, as well as to develop skills needed for scientific communication. Grammar and vocabulary exercises are designed to aid students to get ready for TOEFL examination.

The textbook bears information on students' life and educational systems in the USA and UK. It contains terminological glossary and English-Ukrainian vocabulary of 1000 words.

The manual is intended for use of students and graduate students of higher schools who plan to major in Natural sciences. It can appear helpful in the course of scientific-technical translation at schools and colleges.

УДК 811.111 (075.8)

ISBN 978-617-8672-04-1

П Е Р Е Д М О В А

Навчальний посібник «Англійська мова для природничих наук» призначається для студентів спеціальності 014 «Середня освіта (Природничі науки)» університетів і вищих навчальних закладів, а також може бути використаний на заняттях з науково-технічного перекладу у школах, ліцеях.

Метою посібника є розвиток практичних навичок володіння мовою в обсязі, необхідному для роботи з літературою з фаху, усного та письмового спілкування у науковій сфері. Ця мета реалізується через вибір матеріалу та систему вправ посібника.

Поряд із професійно-орієнтованими матеріалами, які допомагають студентам оволодіти усіма видами мовної діяльності, посібник містить багато корисної інформації про діловий аспект мови науки: науковий етикет, складання документації, листування, електронні повідомлення, анкетування, написання заяв, запитів, CV, так званих «cover та follow-up letters», звітів, реферування, анотування, ведення телефонних розмов, дискусій, участь у конференціях тощо, які моделюють різні ситуації наукового спілкування. Система граматичних і лексичних вправ, яка використовується в посібнику, сприяє ефективній підготовці до складання іспиту TOEFL.

Посібник містить багато країнознавчої інформації, зокрема про життя студентів та систему освіти англомовних країн.

Навчальний посібник «Англійська мова для природничих наук» складається з 12 уроків. В уроках пропонується тест для самостійного контролю рівня засвоєння навчального матеріалу.

Підсумкові тести можуть бути використані викладачами як моделі для створення семестрових та річних модульних контрольних робіт.

Unit One

Exercise I. Pronounce the following words:

department
handle
challenge
curriculum
vital
meaningful
worthwhile
technique
focus
objective
graduate
acquire
knowledge
research
facility
career
purpose

Exercise II. Pronounce the following:

previous time
vital part
creative thinker
study programme
technical skills
well-rounded student
in-depth training
academic career
experimental technique

Text A

EDUCATION

Keywords: *education, department, student, school year, graduate, curriculum, knowledge, skills, in-depth training, professional position, academic career.*

Education today is perhaps 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. Today we depend on science and technology, so everybody should know about it and its contribution to society, understand its potential and limitations. 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, it is the language of all scientific conferences, of major scientific journals and informal discussions in hallways of symposia and congresses of scientists all over the world.

So, the focus of education is on the Learner, and the goal 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 program 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 faculty develops a curriculum that produces a well-rounded student with good training in a chosen area of research.

For chemists the program 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. Geology and geography faculties train geologists, mineralogists, volcanologists, seismologists, oceanographers, 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. Future physicists study optics, astronomy, theoretical physics, nuclear physics, radio-physics, physics of solids, molecular physics, etc. Computer scientists trained at faculties of cybernetics are wanted at scientific laboratories, schools and universities, industrial facilities, banks and commercial companies.

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 familiarized 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.

VOCABULARY AND COMPREHENSION

Exercise III. 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 IV. Study the definitions of the following words.

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 cpllege.
Skill	-	ability or proficiency.
Technique	-	method of procedure, scientific operation.
Facility	-	means by which something can be easily done.
Department		

Exercise V. Give English equivalents of the following words and word combinations.

Скористатися найкращим чином, відвідувати лекції, стати членом клубу або товариства, зайняти своє місце, вести дослідження, мета навчання, галузь хімії, гуманітарні дисципліни, громадська діяльність.

Exercise VI. According to the text the focus of educational system is on:

- instructors;
- students;
- creative thinkers;
- graduates.

Exercise VII. It can be understood from the text that basic material is presented in the form of:

- lectures;
- lectures supplemented by seminars and laboratory exercises;
- lectures, seminars and colloquia.

Exercise VIII. Choose the words, which are synonymous to the underlined ones.

Curriculum	**Investigation**	**Technique**	**Vital**	**Exercise**
a) programme	a) study	a) way	a) serious	a) rework
b) textbook	b) experiment	b) method	b) important	b) practice
c) plan	c) practice	c) analysis	c) essential	c) job
d) timetable	d) work	d) skill	d) alive	d) activity

Exercise IX. Translate proverbs and sayings with the words teach, learn and their derivatives.

Remember: *to teach is to instruct, to give lessons; to learn means to be instructed, to receive lessons.*

Quickly learnt, quickly forgotten. Learn like a parrot. To learn one's lesson. To teach somebody a lesson. A little learning is a dangerous thing. 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 X. Arrange the words given below according to the area of their usage.

Lecture, meeting, seminar, exhibition, club, faculty, laboratory, thinker, mathematics, teaching skill, discussion, in-depth training, curriculum, professional position, colloidal, crystal, technique, timetable, film.

Education	Art	Science
??	**??**	**??**

Exercise XI. Give opposites of the following phrases. Check your answers in a dictionary.

a) Good knowledge, well-rounded student, inorganic chemistry, traditional field, basic material, meaningful years, years ahead, working world, important skills, practical knowledge.

b) To make the best of, to acquire skills, to attend classes, to join a society, to graduate from a college, to take a position.

Exercise XII. Paraphrase the following sentences, substitute words and expressions from the text for the underlined parts of the sentences.

1. The focal point of any teaching system is a student. 2. The aim of a study program is to educate a well-prepared specialist with deep knowledge in general and special chemistry. 3. Basic material is delivered in the form of lectures, class debates, seminars and laboratory practices. 4. In a laboratory students acquire experimental operations and study various instruments and equipment.

Exercise XIII. There are some extracts from the announcements of different divisions and offices of an American college. Guess what offices issued them.
A list of college divisions and offices:

Office of the University Bursar, Office of University Housing, Student Life Office, Dean's office, Office of Financial Aid, Student Health Services Centre, Library.

1. Possession of a photo identification card is required of all students. ID pictures should be carried at all times so you may freely enter buildings and access all University areas. The card will serve as your library card. Students using computer facilities must also have a valid ID card.

2. Fees are payable between 8 a. m. and 5 p. m. Monday through Friday. For a student desiring to use a credit card, Master Card and Visa are honored by the University. All payments must be made prior to the beginning of classes. If, for any reason, a student does not pay in time, a penalty of 50 $ per week will be charged to his/her account.

3. In accordance with New York State Department of Health law, all students born on or after January 1,1957 must show proof of immunity to measles, mumps and rubella before registering. If you have not submitted proof you will not be permitted to register.

4. Housing fees for the spring semester are due on January 1. The spring semester fees are listed by room type.

Marlton House Double	$2,355
Marlton House Single	$2,670
Marlton House Double/Bath	$2,800
Marlton House Large Double/Bath	$3,120
Marlton House Single/Bath	$3,260

5. Students who need assistance in planning payment of the tuition should apply for financial aid. Please, contact us for further details and application.

6. Sophomore Year Workshop.

Tuesday— March, 14.

1-3 students from each department are present to speak of life in the department they chose, expectations of the department, facilities, faculty, fellow students and coursework. Each department has a table set-up, this will allow for an informal discussion with the Chair.

7. Admittance to "The Library must be approved by the Librarian. During the regular school day a pass must accompany all students. Being noisy, disruptive, etc. will result in disciplinary actions. A minimum suspension from the library will be for a two-week period. All students must have in their file a signed copy of rules and regulations of the library.

Exercise XIV. Translate the following sentences using words and expressions from the text.

1. Роки навчання в університеті чи інституті — найкращі роки у житті молодої людини.

2. Метою навчальної програми на хімічному факультеті є надання глибоких знань у галузі загальної та спеціальної хімії.

3. Освіченій людині завжди легко знайти своє місце у житті.

4. Крім теоретичних знань студенти набувають практичних навичок роботи в лабораторії.

5. Студенти також вивчають фізику, математику, іноземну мову, ісгорію та інші гуманітарні науки.

6. Громадська активність — одна із важливих рис сучасних студентів.

7. Роки навчання найкращим чином готують молодих людей до їхньої кар'єри у промисловості, науці, освіті та мистецтві.

Text B
WHY IS THE OCEAN BLUE?

Why is the ocean blue? People have wondered this for hundreds of years. One idea is that it reflects the sky. And it does—on the surface. From the coast, it may appear a deep blue on a sunny day. Or gray when it's stormy. Or even turn a brilliant pink during sunrise or sunset. But if we sink below the surface, the blue color remains. Here, the water isn't reflecting the sky. The blue hue is created by water itself.

Sunlight contains the full spectrum of visible colors, from red to violet and the whole rainbow in between. Different colors of light have different wavelengths. Red light has long wavelengths. Other colors have progressively shorter wavelengths, with blue and violet the shortest of all.

When light shines through water, colors with longer wavelengths are absorbed by the water, with the longest wavelengths absorbed first. As soon as we get more than a few meters underwater, most red and orange have vanished entirely. Next to go are yellow and green. Blue and violet, on the other hand, have the shortest wavelengths of visible light, so they are able to penetrate the deepest. Not only do they stick around, they're scattered by particles in the water, making it seem as though the water itself is blue. Many deep-sea animals are red. The only light found in the depths of the ocean is blue.

Other things can change the color of the water. Silt and sand may wash into the ocean from land. Or churning waves may lift them up from the sea floor. These sediments reflect more of the longer wavelengths of light, turning the water shades of brown. Water can also appear green—or red—in areas with lots of phytoplankton. These tiny plant-like algae live near the surface, turning sunlight into energy that feeds the ocean ecosystem. They contain molecules like chlorophyll that absorb some wavelengths of light and reflect others.

Shallow areas with clear water often appear turquoise. That's because light reaches the ocean floor. It bounces off the sandy bottom, which turns the water a brilliant blue. Extremely shallow areas still have some of the green wavelengths of light. This creates the green-blue hues that we see in areas around islands and reefs, such as those in the Caribbean Sea.

Of course, as we go deeper and deeper, eventually there's no sunlight at all. As a result, many deep-sea organisms are either black or red. This is because a red surface absorbs blue light, effectively making these animals invisible under the tiny amount of light that filters down from above. At the same time, many organisms that live in the deep ocean have evolved the ability to produce their own light. This is known as bioluminescence. Organisms use it to communicate with other animals, find mates, and hunt for food.

WORD-BUILDING

Exercise XV. Do you see any connection between these words? Put the words, which have some connection into separate groups. What suffixes are used to form a doer's name?

Educate, teacher, learn, produce, thinker, student, learner, researcher, educator, study, think, producer, research, investigate, teach, investigator, do, doer.

*Exercise XVI. How many words can you make using the root **chem**? Consult a dictionary.*

Exercise XVII. Use the prefix self- to form English equivalents of the words given below. Consult a dictionary.

Reference words: defense, service, government, expression, esteem, control, discipline, love, protection, respect, improvement and devotion.

Самодисципліна, самозахист, самоконтроль, самооцінка, самовираження, самоврядування, само обслуга, самозбереження, самовідповідальність, себелюбство, самоповага.

GRAMMAR STRUCTURE

The Verb «To Be» (Present, Past and Future Simple Tenses)

Comparison of Adjectives

Present Simple

Pronoun + verb

Positive		Negative		Question
I am	**I'm**	**I am not**	**I'm not**	**Am I... ?**
He is	**He's**	**He is not**	**He's not / he isn't**	**Is he... ?**
She is	**She's**	**She is not**	**She's not / she isn't**	**Is she... ?**
It is	**It's**	**It is not**	**It's not / it isn't**	**Is it... ?**
We are	**We're**	**We are not**	**We're not / we aren't**	**Are we... ?**
You are	**You're**	**You are not**	**You're not / you aren't**	**Are you... ?**
They are	**They're**	**They are not**	**They're not / they aren't**	**Are they... ?**

Past Simple

Pronoun + verb

Positive	Negative	Negative (short form)	Question
I was	**I was not**	**I wasn't**	**Was I...?**
He was	**He was not**	**He wasn't**	**Was he...?**
She was	**She was not**	**She wasn't**	**Was she...?**
It was	**It was not**	**It wasn't**	**Was it...?**
We were	**We were not**	**Weweren't**	**Werewe...?**
You were	**You were not**	**You weren't**	**Were you...?**
They were	**They were not**	**They weren't**	**Were they...?**

Future Simple

Pronoun + verb

Positive	Negative	Negative (short form)	Question
I shall be	**I shall not be**	**I shan't be**	**Shall I be...?**
He will be	**He will not be**	**He won't be**	**Will he be...?**
She will be	**She will not be**	**She won't be**	**Will she be...?**
It will be	**It will not be**	**It won't be**	**Will it be...?**
We shall be	**We shall not be**	**We shan't be**	**Shall we be...?**
You will be	**You will not be**	**You won't be**	**Will you be...?**
They will be	**They will not be**	**They won't be**	**Will they be...?**

Exercise XVIII. Fill in the form of to be that agrees with the subject.

1. Education ... very important for ambitious young people.
2. It... a vital part of their life.
3. Students ... always in the focus of any educational system.
4. The goal of teaching at a department of chemistry ... to train a well-rounded specialist both in general and special chemistry.
5. A school year ... divided into 2 semesters.
6. The curriculum for a spring semester ... discussed at the Dean's office.
7. According to the curriculum basic material... presented in the form of lectures.
8. Many students of our department ... members of the University sports and art clubs or societies.

Exercise XIX. Read aloud the questions given below using contractions.
Example: ***What is your name? (What's your name?)***

1. Where is he from? 2. Who is his instructor? 3. What is his specialization? 4. Who is the Dean of this department? 5. Where is his department situated?

Exercise XX. Write and pronounce contracted forms for:

I + am = _____

you + are = _____

he + is = _____

they + are = _____

it + is = _____

I + am not = _____

you + are not = _____

we + are not = _____

they + are not = _____

Exercise XXI. Supply the missing apostrophes

1. Its an interesting problem.
2. Hes not in the laboratory now.
3. Theyre members of the University dancing company.
4. Whos your lecturer on organic chemistry?
5. Theyre going to take part in this conference.
6. Whats your home task for today?
7. Shes not in the library right now.
8. Were students of the department of chemistry.

Exercise XXII. Rewrite the following sentences making them interrogative. Then give short negative answers.

1. Students will be asked to pay a tuition fee during a semester. 2. There are excused absences or cut allowances in American colleges. 3. Progress in classes is reviewed every month. 4. Grades in the middle of semester are part of the official transcript. 5. Financial aid was affected when student's grade point dropped to 2.5. 6. Courses are added and dropped during a semester.

Comparative and Superlative of Adjectives

Short words

Comparative degree
(вищий ступінь)
Short + er = shorter
Small + er = smaller
Heavy + ier = heavier

Superlative degree
(найвищий ступінь)
Short + est = the shortest
Small + est = the smallest
Heavy + iest = the heaviest

Long words

Comparative degree
more + important = more important

Superlative degree
most + important = most important

Notice: little – less – the least, good – better – the best, bad – worse – the worst, many – more – the most

Exercise XXIII. Make all possible comparisons.

Tips:

1. Ann is a freshman (a first-year student). She is 18 years old.
2. John is a freshman (a first-year student). He is 18 years old.
3. Helen is a sophomore (a second-year student). She is 20 years old.
4. Nick is a junior (a third-year student). He is 21 years old.

5. Mary is a senior (a fourth-year student). She is 22 years old.
6. Julia is a graduate (finished studying). She

	More... than		**To make comparisons To**
	As... as		**make equal comparisons**
Use:			
	Not so... as	}	**To negate equal comparisons**
	Not as... as		

1. Ann and John (old).
2. John and Nick (young).
3. Sophomore and freshman (experienced).
4. Mary, Nick, Ann, Julia (young).
5. Graduates, juniors, sophomores, freshmen (in-depth trained).
6. Ann and Nick (good sportsman).

If in your comparisons you use such expressions as half, twice, three times, etc. an adjective should stand in the positive degree between as ... as:

His car is half as expensive as mine. This lab is twice as large as that one. He spent half as much money as we did on the project. This computer is twice as clever as that we had before.

But use one «as», if there is no other object of comparison in the sentence:

His car is half as expensive. This lab is twice as large. This computer is half as clever.

Exercise XXIV. Fill in a copy of your CV (Curriculum Vitae). Please write in block capitals.

A B C D F E G H I J K L M N O P Q R S T U V W X Y Z

Curriculum Vitae

Surname: _____
First name: _____
D. o. B.
(date of birth) _____
Place of birth _____
Marital status: _____
Children: _____
Address: _____
Tel no: _____

Education and studies

Dates	**Schools / Colleges (name and address)**	**Qualifications**

Experience

Dates	Place of work (address)	Job

Names and addresses of two referees: _____

Exercise XXVI. Read the «directory information» provided by Offices of Student Affairs in American colleges and write the similar form about an imaginary student.

The University upon request will provide certain information about any student. This information includes a student's name, address, telephone number; parents or legal guardian's name, address and telephone number; academic standing; participation in activities and sports; weight and height of members of sports teams; degrees and awards; other educational institutions attended by the student.

Exercise XXVII. Complete the student's personal form given below.

Student's form

Name _____ **Academic Affiliation** _____
Date of Birth _____ **Age** _____ **Sex** ___ **Specialisation** _____
Place of Birth _____ **Occupation** _____
Current Citizenship _____ **Name of Parent/Guardian** _____
Current Address _____ **Permanent Address** _____
Current Phone Number_____ **Permanent Phone Number** _____

Academic honours

Indicate any academic honours you have received. Include dates.

Travel and study abroad

If you have participated in any programs outside Ukraine, please provide a brief description below.

References

Please list the names, title, place of work and the addresses of the three individuals who agreed to complete personal reference forms for you.

Name **Title and Institution** **Address**

Signature _____

Exercise XXVIII. Complete your personal statement to apply to a university. Briefly describe your reasons for applying to the undergraduate degree program. What do you hope to attain by attending college?

Exercise XXIX. Read the extract given below and compare penalty systems at American and Ukrainian schools.

In some American schools they have a penalty point system that is used for two major reasons:

a) to correct behavior of those who fail to follow the school rules; b) to establish a better learning environment for those who want to receive a quality education. The point system operates as follows: when a student receives a misconduct report or violates rules, the principal makes the decision how many penalty points he will be assigned. If a student receives seven points he is placed on disciplinary probation and a letter is sent to his parents. When he receives ten points, a minimum of a Saturday~3etention or a three-day suspension is applied. The following point system is automatic.

1. Cutting lunch line: 2 points.
2. Eating and drinking in gym: 2 points.
3. Throwing food: 3 points plus cleanup duty for a week.
4. Eating and drinking soda in class: 2 points.
5. Entering library without a pass: 2 points.
6. Stopping in lavatory on way to library: 4 points.
7. Running in halls: 1 point.
8. Sending out of class and failure to report about it to the office: 3 points.
9. Being outside a building between periods: 2 points.
10. Being in cafeteria before lunch bell except those on duty: 2 points.
11. A driver who takes more than one passenger will be given: 4 points.
12. Use of profanity: 2 points or a Saturday detention.
13. Forging a note: 3 points or Saturday detention.
14. Throwing snowballs (including a parking lot): 2 points.
15. Wearing a hat in class: 2 points.
16. Arriving at school after 8.30 a. m. without a note or phone call from parents: a Saturday detention.
17. Cutting classes: a Saturday detention.

(Saturday detention means coming and staying in school from 8:00 to 12:00. A student must bring plenty of reading material. Failure to serve the detention results in automatic suspension.)

Exercise XXX. Here are two dialogues. Use them as models to introduce yourself in formal and informal situations. Develop these dialogues further.

Good afternoon. I am Peter Brick. I am a first-year student, group № 2, chemistry department. Can I speak to the Dean, please?..

Hi, I am Peter. Nice to meet you. I'm a freshman at chemistry department...

Here are other useful expressions you can use in such situations.

Good morning. May I introduce myself? My name is Peter Brick and I am a new student of...
How do you do? I am Peter Brick.
Hello, how are you? How are things?
Hello again. How are you getting on?
How are you doing?

In response you may hear the following.
Good morning. I am Tom Brown. Pleased to meet (nice to meet) you Mr. Brick.
Good afternoon Mr. Brick. Can I help you?
Hello. How are you?
Morning, Peter. Nice to see you again.

Here are some expressions to end your meeting.
Goodbye! It was nice to meet you. Have a nice day.
Goodbye and thanks for everything. Give my regards to...
See you later. Take care.
See you tomorrow. Have a good evening.
See you later, alligator. (Student slang).
Bye!

Exercise XXXI. In pairs, ask and answer questions about your biographies.

Ask about
1. **date and place of birth**
2. **age**
3. **present address**
4. **parents and relatives**
5. **education**
6. **professional interests**
7. **hobbies**
8. **plans for the future**

Please, find below some tips to help you with the questions. All you have to do is to put verbs in the appropriate tense and person.

When antTwhere \ to be \ you bom?
How old \ to be \ you?
Where \ to do \ you currently live?
What \ to be \ your parents?
What schools \ to do \ you attend?
What \ to be \ your future speciality?
What \ to be \ your hobby?
What \ to be \ your plans for the future?

Now ask questions and give answers according to the model: «Where do you come from» — «I am from Italy». Use the list of the European Community countries, Eastern Europe countries and North and South American states compiled beforehand Role-play a meeting in a group of international students at your college.

Supplementary text

FOREIGN EDUCATIONAL ENVIRONMENT:
EDUCATION IN GREAT BRITAIN

School is compulsory in Great Britain until the age of 16. Children start formal education at 5 and many of them complete 13 full years of schooling at 18. But not all. Some can leave school at 14 or 16 after the fifth form. To leave school and go to other educational institution (vocational or technical schools, as a rule) they have to take the exam for General Certificate of Secondary Education. Pupils must take English language, Math and Science for GCSE, as well as a half GCSE in a foreign language and Technology.

Private schools include public and tutorial schools. Most of these are single-sex boarding schools, where students study and live. The public schools provide well-rounded education, paying attention to academic disciplines, art, music and sports. Once they were established to educate the monarchy and aristocracy, and some have almost 1000-year old history. Such public schools as Eton, Harrow and Roedean are very expensive and during their long history educated manymonarchs and leaders of many countries of the world. Tutorial schools have smaller classes, personal tutoring here focuses on academic subjects only; that's why tutorial schools have smaller campuses with no sports facilities.

Most secondary schools in Britain are comprehensive schools. These are state schools, which take children of all abilities. About six per cent of students go to grammar schools, state schools which only take students who pass an examination at the age of 11.

In 1988, for the first time in British history, a National Curriculum was introduced. It tells pupils which subjects they have to study, what they must learn and when they have to take assessment tests.

So, at the age of 16 pupils can leave school. If they stay on, in two years they usually take a higher level of secondary school exam, the so called A (advanced) level required by UK universities.

Most big towns in Britain have both a university and a college of higher education. There are 169 universities and colleges in UK with more than 1.8 million students studying there. Universities offer two-, three- and four-year degree courses, leading to a Bachelor of Science or Bachelor of Arts degree. A degree is a qualification students get from the university when they pass their final exams. They are then awarded a B. A. (Bachelor of Arts), B. Sc. (Bachelor of Science) or B. Ed. (Bachelor of Education). Sandwich courses, which include a period of work outside the university, add one year. Medical and veterinary courses require five years of study.

Until 1998, British students did not have to pay to go to university. Now they must pay about 10 thousand pounds a year as a tuition fee.

Competition to get into British universities is tough and not everyone who gets levels can go. Students usually apply to universities months before they take their A levels. They are given a personal interview and the university decides which students it wants. The place, which a student is offered, depends on his or her A level results. The more popular is the university, the higher the grades it will ask for.

Oxford and Cambridge are the oldest universities in Britain and they have the highest academic reputation.

Note: British English and American English have some differences in various aspects of the language. In the present textbook you may encounter both variants, since some illustrative materials have been taken from American, as well as from British scientific and scientific popular literature. Mind the necessity to choose an appropriate form according to the specific area of communication (American/British scientific journals, correspondence, conferences held in USA/UK, etc).

Mini-Test

1. Write 10 keywords of the Unit.
2. Write English equivalents of the following word combinations.
   Відвідувати лекції, вести дослідження, мета навчання, галузь хімії, громадська діяльність

3. Match the words. ***Skill Curriculum Technique Education***

Ability or proficiency;
A course of study in a college.
The process of developing knowledge or skills;
Method of procedure;

4. Give synonyms to the following words:

A first-year student, a second-year student, a junior, a senior, a goal, curriculum, investigation, method, job, education.

5. Give antonyms to the following phrases.

Good knowledge, bad academic standing, previous time, years ahead, well-rounded student.

6. Make the following sentences negative.

a) Students are in the library now; b) Laboratory exercises are very painstaking; c) A student is in the Dean's office at the moment; d) He is a first-year student.

7. Make question from the sentences.

a) A freshman is a first-year student of an American college; b) Basic material is presented in the form of lectures; c) Laboratory exercises are very useful; d) Class discussions and seminars are a vital part of curriculum.

8. Make comparisons.

a) School curriculum and college curriculum (complex).
b) Juniors and freshmen (experienced).
c) Chemistry, mathematics, English (difficult).
d) Spring semester and autumn semester (short).

Unit Two

Exercise I. *Pronounce the following words:*

matter
chemistry
science
substance
structure
reaction
transform
laboratory
technology
term
notion
concept
vocabulary

Exercise II. *Pronounce the following word combinations:*

living organism
chemical laboratory
fundamental science
descriptive science
scientific notion
grammar structure
appropriate usage
formal expression

Text A

LANGUAGE OF SCIENCE

***Keywords**: science, biology, chemistry, geography, physics, language, term, origin, word, concept, notion, vocabulary, communication.*

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 term *biology* for exam- ple was coined from two Greek words meaning «life» and «word», or «study of», the same can be said of *geology* Formed from Greek words, which mean «earth» and «study of». *Ecology* originated from Greek *oikos* («house») and *logos* meaning «study of».

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» (the Penguin Dictionary of Science, 1971). Chemistry studies substances, their structure, properties, reactions and transformations. Although the study of matter is also the business of physics, geology, biology, ecology and materials science, 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.

Another peculiarity of the vocabulary is a large number of formal words and expressions in comparison with everyday standard English. A scientist uses the words *to discover, to investigate, to encounter* when he speaks about scientific problems, but prefers to say *to find out, to look into, to come across* or *to meet with* in informal situations.

Appropriate usage of words is always a question of the right choice, and this rule is also valid for grammar structures. The language of science is characterized by the impersonal style; therefore a scientist would rather write *Interesting results are obtained* than *I obtain interesting results.*

For a long period of time science remained descriptive. No wonder, descriptive manner of writing where preference is given to the Present Indefinite structures and definition- or characteristic-like sentences, is frequent in its language.

A high level of theorization characterizes modem science with its hypothesis making and discussions. This demands quite different language style, hypothetical speculations with subjunctive mood structures, modals, conditional clauses, etc.

A scientist not only describes facts or processes, but also narrates them, referring to a past or future period of time; in this case he preferentially uses the Past Indefinite or Future Indefinite Tense forms. Dates and proper names are typical for such narration.

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.

The languages of natural sciences with all their peculiarities have much in common. General trend of unification and standardization, which facilitates communication of scientists of different disciplines and countries, is actively at work.

VOCABULARY AND COMPREHENSION

Exercise III. Answer the following questions.

1. What is the origin of the word «chemistry»? 2. What is the modem definition of this science? 3. Why do we call chemistry a fundamental science? 4. Of what origin are many scientific terms? 5. What are peculiar features of the grammar of the language of science? 6. WTien does a scientist use a descriptive manner of writing? 7. What tense forms are typical for narration? 8. What types of scientific publications are there in scientific literature? 9. How was the term *biology* coined? 10. What is the origin of the word «cybernetics»?

Exercise IV. According to the text, the vocabulary of the language of science is composed of:

a) short words;
b) formal expressions;
c) terms;
d) metaphors;
e) Latin elements.

Exercise V. It can be inferred from the text that the root <u>chem</u> probably refers to Khmi because:

a) alchemy appeared in Egypt;
b) metallurgy was highly developed in the area;
c) Khmi area was known for its glass technology.

Exercise VI. Study the definitions of the following keywords.

Chemistry	-	the science of matter and its changes.
Substance	-	of what things are made, material.
Property	-	any identifying characteristic of a substance such as colour, taste, etc.
Reaction	-	process of transformations of substances.
Term	-	word or word-combination denoting scientific notion.
Notion	-	type of thinking, which reflects objects and phenomena in their characteristic properties.
	-	

Exercise VII. Write the terms for the following definitions.

Science, which studies substances, their properties and reactions.
Manner of writing with preferential present tense forms and characteristic-like sentences.
Special word used to define a scientific notion.
The term coined from Greek words meaning «house» and «study of».
Greek word meaning «word» or «study of».
Science studying history of earth development, its structure and composition.

Exercise VIII. Write English equivalents of the following word combinations.

Вивчення складу речовини, реакції та перетворення, детальне розуміння, особливість словника, високий рівень теоретизації, правильне використання, велика кількість, теоретичні розмірковування, науковий стиль, наукова публікація, наукове спілкування.

Exercise IX. From the following choose the word which is nearly the same in meaning to the initial one.

Study	Change	Term	
a) investigation	**a) motion**	**a) symbol**	**a) idea**
b) work	**b) transfonnation**	**b) sign**	**b) image**
c) analysis	**c) transfer**	**c) special word**	**c) concept**
d) treatment	**d) exchange**	**d) word**	**d) word**

Exercise X. *Arrange the words given below according to the specific area of usage.*

The list of the words: science, analysis, term, definition, vocabulary, reaction, matter, transformation, tense-form, style, root, property, metal, thesis, article, precipitation, oxidation.

Exercise XI. Compare two announcements. State which of the two is more formal. Why?

ANNOUNCEMENTS FROM THE LIBRARIAN

1. It has been noted with concern that the stock of books in the library declined alarmingly. Students are asked to remind themselves of the rules for the borrowing and return of books, and to bear in mind the needs of other students. Penalties for overdue books will in the future be strictly enforced.

2. The number of books in the library has been going down. Please make sure you know the rules for borrowing, and don't forget that the library is for *everyone's* convenience. So from now on, we're going to enforce the rules strictly. *You have been warned!*

(The announcements are taken from a Communicative Grammar of English by G. Leech, London, 1975.)

Reference words:
note with concern — відмічати із занепокоєнням;
rules for the borrowing and return of books — правила видачі та повернення книжок;
bear in mind — пам'ятати;
penalties for overdue books — покарання за несвоєчасне повернення книжок;
for everyone's convenience — для загальної зручності;
to enforce penalties — посилювати покарання (штраф);
to warn — попереджувати.

Exercise XII. Open the brackets and choose the correct word to make the sentence true.

The word «chemistry» is of (English, Latin) origin. Chemistry studies (substances, energy). Chemistry is a (fundamental, applied) science. Chemistry gave origin to (geochemistry, ecology). The language of chemistry is highly (expressive, terminological). International Union of Pure and Applied Chemistry recommends that the names of compounds should be built on the basis of (Latin, English) elements. A large number of (terms, synonyms) is typical for the language of chemistry. The scientific language is characterised by (personal, impersonal) style of writing.

Exercise XIII. Use your dictionary to translate the following into English.

Номенклатурна комісія Міжнародної спілки чистої та прикладної хімії (ШРАС) рекомендує будувати назви сполук на основі коренів латинських назв елементів. Національна комісія України з питань хімічної термінології також додержується цих рекомендацій. У 1994 році ця комісія прийняла новий стандарт латинізованих назв хімічних елементів, адже уніфіковані для всіх мов терміни дозволяють нагромаджувати в сучасних комп'ютерах значну кількість інформації про хімічні речовини.

Рекомендовані назви елементів, простих речовині приклади назв аніонів та катіонів

Сим-вол	Рекомендована назва елемента	Латинська назва елемента	Українська назва простої речовини	Приклад назви катіона	Приклад назви аніона
Ag	Аргентум	Argentum	Срібло	Аргентум (I)	Аргентат
As	Арсен	Arsenicum	Миш'як	Арсен (III)	Арсенат
Au	Аур ум	Aurum	Золото	Аурил (I)	Аурат
Bi	Вісмут	Bismuthum	Вісмут	Бісмутил (III)	Бісмутат
C	Карбон	Carboneum	Вуглець	Карбоніл (II)	Карбонат
Cu	Купрум	Cuprum	Мідь	Купрум (I)	Купрат
F	Флуор	Fluorum	Фтор	—	Флуорид
Fe	Ферум	Ferrum	Залізо	Ферил (I)	Ферат
H	Гідроген	Hydrogenium	Водень	Гідроген	Гідрид
Hg	Меркурій	Mercurius	Ртуть, живе срібло	Меркурій (II)	Меркурат
I	Іод	Iodum	Йод	Іодил(V)	Іодат (+5)
Mn	Манган	Manganum	Манган	Манганіл (II)	Манганат
N	Нітроген	Nitrogenium	Азот	Нітроній	Нітрат
Ni	Нікол	Niccolum	Нікель	Нікол (II)	Ніколат
O	Оксиген	Oxygenium	Кисень	Оксоній	Оксид
Pb	Плюмбум	Plumbum	Олово, свинець	Плюмбум (II)	Плюмбат
S	Сульфур	Sulfur	Сірка	Сульфурил	Сульфат
Sb	Стибій	Stibium	Стибій	Стибіл (I)	Стибат
Si	Силіцій	Silicium	Кремній	-	Силікат
Sn	Станум	Stannum	Цина, олово	Станіл (II)	Станнат

Text B

SEARCHING FOR LIFE ON OTHER PLANETS

The possible existence of life elsewhere in our solar system or in the uni- 1 verse is one of the most profound issues that we can contemplate. Whatever the answer turns out to be - whether life is present elsewhere or absent - our view of the world and our place within it will be dramatically affected. If a single example of even the most rudimentary life form can be found on another world, that will tell us that the origin of life is not unique to the Earth. We will not be able to help but wonder if intelligent life exists that is more advanced or more sophisticated than us. We will wonder whether the paths that we have chosen as a society are the most beneficial paths. Indeed, it would be a very humbling experience to realize that we are not alone in our existence. On the other hand, if no evidence is found suggesting other life, we may view the Earth and all its inhabitants with a narrow, pinhole focus that makes us unique, on an isolated plane within a vast universe. This view is well expressed in the thought, attributed variously to either the philosopher Bertrand Russell or the science-fiction writer Isaac Asimov, 'There are two possibilities. Maybe were alone. Maybe we're not. Both are equally frightening.'.

Ours is the first generation that can begin to address in a thorough manner the scientific details of the origin of life on the Earth and the possibilities of the existence of life elsewhere in the universe. Although we do not understand the specific details of the origin of life on Earth, we have learned a great deal about the conditions that surrounded the earliest life.

In addition, we have just begun to explore the rest of our solar system and to look for planets outside of it. Most of the planets in our solar system have been visited with spacecraft, and humans have walked on the surface of the Moon. Many details regarding the climate and habitability of the other planets are now understood, and the search for evidence of other life can begin. The Viking spacecraft was used to look for life on Mars in the late 1970s - none was found - but we now know that Viking might have been searching in the wrong place or with the wrong instruments.

The discovery in 1995 and 1996 of planets orbiting around other stars lends immediacy to the question of life in other solar systems. Although these planets were expected to exist, such expectations were built on theory rather than observation. Their actual detection is a discovery of paramount importance. Even though the new planets are for the most part more Jupiter-like than Earth-like, we can use their existence to begin constraining theories that apply to all planets. Certainly, Earth-like planets - planets with a solid surface, an atmosphere, and the possibility of liquid water on the surface - are expected to exist around other stars, but our telescopes are not yet able to detect them. Knowing that there are Jupiter-like planets, however, gives us impetus to search for Earth-like planets.

Recent advances in our understanding of terrestrial biochemistry also fuel the search for extraterrestrial life. They demonstrate that life can exist within a much wider range of environmental conditions and can utilize a much wider variety of sources of energy than was previously thought. They also suggest that there are many distinct ecological niches on the Earth that could have served as the location for the origin of life. Although we do not know for certain where life on Earth originated, we can appreciate that other planets might have life that began in any of several places. If life is as flexible as it appears to be based on our experience on Earth, then it is possible that a wide variety of planets, both within and outside our own solar system, might have originated life and be harboring it at the present. As much as the advances in astronomy and planetary science have opened up our view of the solar system and the universe, the advances in biology have opened up the possibility of abundant life in the universe.

The goal of this book is to present a broad-based view of the scientific underpinnings of the search for extraterrestrial life. And, we know more today than we have at any time in the past about what qualities a planet must possess in order to potentially contain life. We should recognize up front that there is no unambiguous evidence today that suggests the existence of any life in the universe other than on our own planet. This does not mean that there is no life, only that we have just begun the search. Our tools for scientific exploration are just reaching the point where we can begin to address these questions meaningfully.

The lack of evidence for life should be perceived as an absence of information rather than an absence of life or an indication that life might be unlikely to exist elsewhere.

The field of exobiology (or bioastronomy) - which deals with the study of extraterrestrial life - should be viewed in the broadest sense. Exobiology does not refer only to the study of biological activity on other planets (especially since we know of none today). It also refers to the occurrence of nonbiological and prebiological chemical processes, the distribution of planets within the universe, and the habitability of all planets.

WORD-BUILDING

It is interesting that the suffix «ry» like that in the words sophistry (софістика) or palmistry (хіромантія) probably denoted the lack of respectability in the 17th century. In 1652 chemistry was described as «a kind of cheating magic». You see how informative a word-building elemeni might be and what a long history chemistry passed from contempt to respectability and recognition!

Exercise XIV. a) Study the names of sciences. What suffixes are used to build them?

Geology, geography, biology, ecology, biochemistry, cybernetics, physics, linguistics, philology, and mathematics.

b) Use your dictionary to write the names of professions in the above fields of science. Underline the suffixes.

Exercise XIV. Translate into English.

Українські хімічні терміни мають латинський корінь та закінчення -їм, якщо латинська назва закінчується на *-ium.* Наприклад, Stibium — Стибій, Silicium — Силіцій, але з цього правила є винятки: Uranium — Уран, Praseodium, але Празеодим, Nepdymium — Неодим. Якщо латинська назва не має закінчення, воно відсутнє і в українській назві Sulfur — Сульфур.

GRAMMAR STRUCTURE

Present, Past and Future Simple Tense

Comparisons of Adverbs

	Personal pronouns	**Present Tense verb**	**Future Tense verb**
Positive	**I**	**read**	**shall read**
	You	**read**	**will read**
	He		
	She	**reads**	**will read**
	It		
	We	**read**	**shall read**
	They	**read**	**will read**
Negative	**I**	**do not read**	**shall not read**
	You	**do not read**	**will not read**
	He		
	She	**does not read**	**will not read**
	It		
	We	**do not read**	**shall not read**
	They	**do not read**	**will not read**

	Question operator in Present Tense	Personal pronoun	Verb
Interrogative	**Do**	**I**	**read**
	Do	**You**	**read**
	Does	**He**	**read**
		She	
		It	
	Do	**We**	**read**
	Do	**They**	**read**

	Question operator in Future Tense	Personal pronoun	Verb
Interrogative	**Shall**	**I**	**read**
	Will	**You**	**read**
	Will	**He**	**read**
		She	
		It	
	Shall	**We**	**read**
	Will	**They**	**read**

Consult your grammar textbook to make up the Table with the Past Simple forms of the verb to love.

Comparisons with adverbs may be equal or unequal. Their comparative and superlative degrees are normally formed using more or less, most or least.

John listens to the lecture the most attentively of all. We work more carefully with toxic chemicals than with non-toxic materials. This reaction proceeds less vigorously than that one. They participated in the conference as actively as we did.

Again comparisons. Notice a very special sentence structure with comparatives. Translate some sayings where such structures are used Be aware of «the»-article usage here.

The more you live the more you learn. The more the better. The more the merrier. The fewer the better. The more you learn the more you know. The more you think of it the better you understand the situation. The earlier he leaves the sooner he returns.

Exercise XV. Fill in the correct form of the verb in the blank space. Keep the tense of the original sentence.

1. We study chemistry. He_____ chemistry.
2. I leam terms. She _____terms.
3. They read a dictionary. She _____ a dictionary.
4. He writes an exercise. We _____ an exercise.
5. You like biochemistry. He_____ biochemistry.
6. They will watch reactions. I _____ reactions.
7. We shall discuss results. You _____results.

Exercise XVI. Open the brackets and choose the correct form of the verb.

Chemistry (study, studies) the composition of substances. Many sciences (finds, find) their way in chemical laboratory. They (want, wants) to know of what things are made. Biochemists (studies, study) chemical processes in living organisms. Geochemistry (investigates, investigate) chemical composition and processes of our Earth. Chemistry (knows, know) answers to many questions of Nature.

Exercise XVII. Change sentences into negative whenever it is necessary for the passage to be correct.

Each science elaborates a specific language to describe objects of its investigation. Chemistry is an exception. Its language is similar to everyday standard English. There are many special words in it. These words term objects and phenomena which chemists study. Grammar structures of scientific languages differ from those of the standard written English.

Exercise XVIII. In the questions fill in the correct form of to do or to be.

A. 1. ... chemists use specific language to speak about their science? 2. ... chemistry and biology descriptive sciences? 3. ... the language of science include various styles of writing? 4. ... the vocabulary of the language of chemistry similar to that of standard English? 5. ... you know what the term «transformation» means? 6. ... the term «analysis» originate from Latin?

B. 1. Language of science is highly terminological, ... it? 2. The term *biology* originates from two Greek words,... it? 3. Science reflects the world in specific notions, ... it? 4. There are many formal words in the language of science,... there? 5. Clarity is a must in scientific writing, ... it? 6. Journals want their authors to follow scientific format, ... they?

Exercise XIX. a) Answer the following questions using there to begin each sentence.

1. How many elements are there in the Periodic table of elements? 2. How many elements with atomic number 1 are present in the Periodic table? 3. Is there free nitrogen in the air? 4. What components are there in table salt? 5. Of how many atoms does the molecule of water consist?

b)Now answer the above questions using the verb to have: Note: the idea of the sentence «There is one electron in hydrogen» is similar to that of «Hydrogen has one electron».

Exercise XX. Rewrite the passage below in the Future Simple Tense. Change time signals if necessary.

Students always carry out their experiments in the laboratory. They observe reactions and discuss results. Today students write essays related to chemistry. They like this kind of work and do it with pleasure. Discussions of the essays usually take place on Monday.

Note: the future can be indicated by to be going to construction. For example, I am going to read this article = I shall read this article. Now change the above sentences using to be going to.

Exercise XXI. Change the following text using Past Simple.

No one deserves the award of Teacher of the Year more than Mr. Hopkins does. He is a man that gives so much of himself to his students to offer a friendly hello in the hallway, or lend an ear if you are in need of a friend. Yet, Mr. Hopkins always commands a certain respect that no one challenges. To just sit in one of his classes is to realise he loves what he is doing and truly cares about his students.

He allows them to think on their own, form their opinion and defend themselves, truly preparing them for the real world.

Exercise XXII. Rearrange the words to make up correct sentences.

1. / leaves / do / why / change / colour / in / autumn /? 2. / bread / is food / why/? 3. / will / chemistry / answer / questions / these /? 4. / matter / what / is /? 5. / changes / how / do / we / explain / chemical /? 6. / exists / matter / three / in / forms /. 7. / matter / scientists / know / changes / that /.

SCIENTIFIC COMMUNICATION

Exercise XXIII. You *can use three ways to write about a substance.*

For example, you just look at iodine and write that «It is crystalline and solid»; that«It is of a dark-blue colour» or «It has a metallic lustre and resembles graphite». By these sentences you describe some characteristic properties of iodine.

Now you want to tell readers a story of this element:

«Bernard Courtois, a French chemist, discovered iodine in 1811. The first publication about the element appeared in 1813 and chemists from different countries began to study it. In 1814 Gay-Lussac named the new element «iodine», from Greek — dark blue, violet».

You can also hypothesis about the element. For example, you may write as follows:

«If we heat the element to 113.5°C, it will melt» or «If there were no iodine compounds, many colouring agents could not exist», or «It is possible that violet solutions of iodine conduct electricity because I_2 molecules dissociate into I+ and I- ions».

These paragraphs are the examples of description, narration and reasoning in science.

Exercise XXIV. Look at the salt on your table and write its descriptive characteristic. Specify its colour, crystalline structure, size, smell and taste. Then attempt to describe water in your aquarium and water plants in it. Use the Present Simple in your descriptions.

Exercise XXV. Say what will happen, if you do not return books to the faculty library on time, you fail at your English exam, you smoke in classrooms, you violate university regulations, and you are often tardy to classes.

\ Exercise XXVI. Extend the following definitions.

Chemistry is a science, which studies substances and their transformations.
Biology studies laws of life.
Ecology is the study of living things in their environment.
Scientific style is a manner of oral or written presentation of material characteristic of scientific communication.

Exercise XXVII. Write 5 sentences about common features of scientific languages.

Exercise XXVIII. Translate the two scientific texts. Guess to what fields of science they belong. How do you know this? What is term percentage in each? What tense forms are typical for the descriptive text and what tenses are preferential in the narrative one?

ANCIENT CELLS

About 3.7 billion years ago the first living organisms appeared on the earth. They were small, single-celled microbes not very different from some present-day bacteria. Cells of this kind are classified as *prokaryotes* because they lack a nucleus (karen in Greek), a distinct compartmentor their generic machinery. Thanks to their remarkable ability to evolve and adapt, they spawned a variety of species"and invaded every habitat the world had to offer.

The living mantle of our planef would still be made of prokaryotes but for an extraordinary development that gave rise to a very different kind of cell, called a *eukaryote* because it possesses a true nucleus. The prefix *eu* is derived from the Greek word meaning «good». Without the eukaryotic cells, the whole variety of plant and animal life would not exist, and no human would be around to enjoy that diversity and to penetrate its secrets.

THE ROCK CYCLE

The rock cycle, the largest and slowest of the earth's cycles, consists of a group of geologic, physical, and chemical processes that form and modify rocks and soil in the earth's crust and mantle over millions of years. This geological cycle is powered by energy from the sun and the internal heat of the earth. The rocks involved in this global cycle can be classified into three major groups — igneous, sedimentary and metamorphic — according to the way they are formed. Igneous rocks, such as granite and basalt, are formed when magma wells up from the earth's upper mantle, cools and solidifies. Exposed igneous rock is gradually disintegrated and decomposed by weathering. Gradually, accumulated sediments of weathered rock and the shells and skeletons of dead animals are compacted to form sedimentary rock. Examples are sandstone, shale, and some limestones. Pre-existing rocks within the lithosphere are transformed into metamorphic rocks by changes in temperature, pressure and the chemical action of fluids. These changes in chemical forms of sedimentary and igneous rocks occur over millions of years.

Exercise XXIX. What can be used as a title to the following passage? Write down its keywords and topic sentences.

Chemists use a symbol system for representing the elements. It is more convenient than writing out the name of the element, more clear and concise. For example, if you want to write in words the reaction between aluminium and hydrochloric acid, you will write:

Two moles of aluminium atoms react with six moles of hydrogen chloride molecules to produce two moles of aluminium chloride molecules and three moles of hydrogen molecules.

Now compare this with the chemical way to express the same thing:

$$\mathbf{2A1 + 6HC1 — 2A1CI3 + 3H_2}$$

Chemists use the symbol system devised by a Swedish scientist Jon Berzelius (1779— 1848). The first letter in the name of the element is a symbol. The letter is always capitalised. Since there are only twenty-six letters in the alphabet and over 100 elements, the names of some elements begin with the same letter. In such cases the first two letters of the name are used. The second letter is never capitalised. For example, the symbol for carbon is C and that for cobalt is Co. Some symbols came from other languages: the Latin name for iron is ferrum, so its symbol is Fe, the German word kalium gave the symbol K for potassium.

Chemical alphabet
(without lanthanide and actinide series)

H (Hydrogen);
He (Helium);
Li (Lithium);
Be (Beryllium);
B (Boron);
N (Nitrogen);
O (Oxygen);
F (Fluorine);
Ne (Neon);
Na (Sodium);
Mg (Magnesium);
Al (Aluminium);
Si (Silicon);
P (Phosphorus);
S (Sulphur);
Cl (Chlorine);
AT (Argon);
Rb (Rubidium);
Sn (Strontium);
Y (Yttrium);
Zn (Zirconium);
Nb (Niobium);
Mo (Molybdenum);
Tc (Technetium);
Ru (Ruthenium);
Rh (Rhodium);
Pd (Palladium);
Ag (Silver);
Cd (Cadmium);
In (Indium);
Sn (Tin);
Sb (Antimony);
Te (Tellurium);

Ca (Calcium);
Sc (Scandium);
Ti (Titanium);
V (Vanadium);
Mr (Manganese);
Fe (Ferrum);
Co (Cobalt);
Ni (Nickel)
Cu (Copper);
Zn (Zinc);
Ga (Gallium);
Ge (Germanium);
As (Arsenic);
Se (Selenium);
Br (Bromine);
Kr (Krypton)
Cs (Caesium);
Ba (Barium);
Hf (Hafnium);
Ta (Tantalum);
W (Tungsten);
Re (Rhenium)
Os (Osmium);
IT (Iridium);
Pt (Platinum);
Au (Gold);
Hg (Mercury);
T1 (Thallium);
Pb (Lead);
Bi (Bismuth);
At (Astatine).

Exercise XXX. Say how many «letters» there are in the chemical alphabet.
How do they combine to form chemical «words» (compounds)? What is the difference between Co and CO?

Exercise XXXI. Say the following in English.

$$2C0 + Oj\ 2C0_2\ 2H_2$$
$$+ 0_2 — 2H_20\ H_2 +$$
$$Cl_2 — 2HC1$$

Exercise XXXII. Continue and role-play the following dialogue.

Teacher **The name of our course is «English Through Chemistry». Can you tell me why?**

Student 1 I don't know.

Teacher Can you help him?

Student 2 Yes, certainly. The language which chemists use in their communication is very specific and has a lot of peculiarities. In other words we can't speak about chemistry in detail simply using everyday English.

So, we study it as a separate variety.

Student 3 I'd like to add that it's very exciting to study another subject where there is plenty of chemistry.

Teacher Both of you are right. When you began to study chemistry some years ago probably it with its symbols was another foreign language to you. The symbols were like letters in the alphabet of which chemical words and sentences, i.e. compounds and reactions, were built. Now let's discuss some analogies which standard English and the symbolic language of chemistry have. We are going to begin with the alphabets...

Exercise XXXIII. Express your personal opinion on the problem. Use the following: to my mind, I personally believe, it strikes me, I feel very strongly, it seems to me, 1 am under the impression, I am
inclined to believe.

In recent years there was a move in UK schools to standardise scientific nomenclature, and to phase out imperial measurements in favour of metric ones. Not only this, but within the metric system itself there is standardisation, so that some of the terms disappeared. For example, students today are happy with metres and centimetres, but seem at a loss when faced with yards, feet and inches. For them energy comes in joules, and force in newtons, but whatever happened to ergs and dynes? Simply measuring height can mean a communication problem between children and their parents. For students even simple things can cause immediate confusion. For example, to them a thousandth of a litre is 1 cm^3, and if to use 1 cc or 1 ml, they looked baffled. They have only a limited view of science, and have some difficulty reading a textbook of physics from only about 30 years ago.

Now, please perform some practical unit transformations after reading the text given below.

There are five main temperature scales named after the persons who invented them. G. D. Fahrenheit (1686—1736), a German physicist, was the first to propose a temperature scale. He took 32 degrees as water freezing point, and 212 degrees as its boiling point. Anders Celsius (1701—1744), a Swedish astronomer, proposed a 100-degree scale in 1742.

It was widely adopted as a centigrade scale. W. Thomson, 1st Lord Kelvin (1824—1907), a Scottish mathematician and physicist, suggested an absolute scale based on the idea of heat. He put forward the idea of «absolute zero» (-273.15 on the Celsius scale).

To change from F to C, subtract 32, multiply by 5, divide by 9 and you obtain temperature in Celsius. To change from C to F: multiply by 9, divide by 5, add on 32.

Transform from F to C: 130°F, 78°F, 56°F. Change from C to F: 20°C, 45°C, 100°C.

Exercise XXXIV. Complete the student questionnaire to provide information about your interests, activities and plans. You may skip any question you wish. Be ready to comment on your answers.

1. Indicate the total number of school years you have taken in the subjects listed below.
   - Natural Sciences (Biology, Chemistry)
   - Ukrainian
   - Social Sciences and History
   - English
2. Please indicate your grade in the subjects.
   - Chemistry
   - Ukrainian
   - History
   - English
3. Please provide information about the content of your school English course.
   - English and American literature -Grammar
   - speaking and listening skills
   - translation skills
   - writing skills
4. Indicate aspects of the English course that interest you.
   - writing
   - speaking and listening
   - translating scientific literature
5. Indicate in what activities you plan to participate.
   - art activity (dancing, theatre, music, etc.)
   - sports
   - foreign exchange or study abroad programme
   - literature activity (for example, faculty newspaper, creative writing)
   - science activity (for example, scientific societies, ecology groups etc.)
   - other activity not listed
   - I don’t plan to participate in any activity
6. Please indicate in which sports you plan to participate.
   - badminton
   - basketball
   - boxing
   - fencing
   - football
   - gymnastics
   - handball
   - ice hockey
   - skiing
   - skating
   - swimming
   - tennis
   - volley bal -

- other

7. Do you plan to look for a part-time job while in the University?
   - yes
   - no
   - I don't know
8. Indicate how certain you are about your choice of the area of study.
   - very certain
   - fairly certain
   - not certain

Thank you for participation!

Describe some hobby you enjoy. List two or three reasons why you like it.

Supplementary Text

FOREIGN EDUCATIONAL ENVIRONMENT: EDUCATION IN THE U.S.A.

In the United States of America children go to school at the age of six. They can attend public or private secondary school. Pupils do not pay for their studies at a public school, but have to pay from 8 to 20 thousand dollars per year in a private institution. Duration of secondary education is 12 years and the diploma awarded is a high school certificate.

There are two types of higher education in the U.S.A. Students can enter a two-year undergraduate college, where minimal requirement of admission is a high school diploma. Tuition fee varies at this type of higher institution from 7 to 24 thousand per year. After taking final exams students receive associate degree in science, applied sciences, arts or business administration.

Admission requirements are higher at four-year colleges and universities. Applicants should send their applications to the university long before the admission deadline. Results of SAT examination that all American high school students write in the middle of the academic year are of primary importance, as well as personal interviews held at all universities.

Tuition fee varies at different universities from 7 to 30 thousand dollars per year. Diplomas awarded are Bachelor of Arts (B. A.), Bachelor of Science (B. Sc.) or Bachelor of Business Administration (B. B. A.). At the conclusion of the fall and spring semester, a Dean's Honor List is compiled to recognize superior academic achievements. Matriculated students are eligible to the Honor List if they obtained a semester grade point average of at least 3.7. Grade point average of 4 is the highest achievement at US universities. ,

It should be noted that there are a variety of means to help matriculated students to meet the costs of attending the university. Any student can apply for financial help. Awards are based on academic achievement, financial need, number of credits taken per semester, government regulations and availability of funds. Financial aid is awarded in the form of grants, loans, and scholarships. A loan must be repaid after graduation with interest.

Exercise XXXV. Compare educational systems of secondary and higher school in this country and the U.S.A. Use the following words and word combinations to show similarities and differences in the systems: like, similar to, while, whereas, in contrast to, as compared to, on the contrary, contrary to, unlike. Exercise XXXVI. Match student jargon words with their Ukrainian equivalents.

To ace an exam, to apple-polish, an apple-shiner, to bomb an exam, a crib note, to classes, to cheat, to flunk an exam, to flunk out.

Провалити іспит, прогулювати заняття, шпаргалка, «вилетіти» зі школи, списувати,здати іспит на «відмінно», підлизуватися до викладача, підлабузник.

Exercise XXXVII. Make some prophecies about your friends at the university, imagining them in the year of 2015. Use Future Simple it your predictions.

Exercise XXXVIII. At some time you may need to write a letter of application for c job. Maybe this coming summer or after you finish the university. Follow the model to write the application letter and the resume.

Pay attention to the fact that any letter should consist of four parts: letterhead (sender's info), opening (addressee's info), contents (body of a letter) and closing (a farewell salutation and signature). Follow the layout of the letter.

Jane Doe 19 First Street
Lansing, Michigan 48914
February 2, 1996

Mr. John Blank, Director
Chicago Park District 425
East McFetridge Drive
Chicago, Illinois 60605

Dear Mr. Blank:

I saw your ad in the Chicago Tribune for a swimming instructor in the Park District Recreatioi Department for the coming summer, and I'd like to be considered for the position.

I am freshman at Lansing Community College, majoring in special education and minoring in physical education.

I have had considerable experience teaching swimming — first with the St. Louis Department ol Parks and Recreation, then at camp Nesdit in Kenton, Michigan, and finally last summer at the day camp of Harris YWCA in Chicago.

It was in the last job that I discovered what I really like to do. I found that teaching swimming to physically and mentally handicapped children was most rewarding, and I'd be happy if I could have at least some classes of handicapped children in your swimming program. The supervisor ai Harris YWCA is going to write you about my work.

I am enclosing a resume and will call you soon to see whether I may come for a personal interview.

Sincerely,

(signature)

Jane Doe

Resume

Jane Doe 000 First Street Lansing, Michigan 48914 Telephone 1234567899

Work experience

1994 summer Swimming instructor at day camp of Harris YWCA,Chicago.
Worked with physically and mentally handicapped kids.

1993 summer Cabin counselor at Camp Nesbit, Kenton, Michigan.
1992 summer Swimming instructor with the St. Louis Department of Parks and Recreation.

Education

Freshman at Lansing Community College, Lansing Michigan.
Majoring in special education; minoring in physical education.
Student at Lansing High School, Lansing, Michigan.

Activities

Swimming Won second place in an intercollegiate swim meeting at Lansing Community College in 1994.

Bowling

References

Ms. Arils Adams, Director Harris YWCA
6200 South Drexel, Chicago, Illinois 60637

Mr. Dave Pickford, Director Camp Nesbit

Box 198, Kenton. Michigan 49943 Mr. John Murphy, Director

County of St.Louis Department of Parks and Recreation 7900 Forsyth Boulevard St. Louis, Missouri 63105

(From «The Least You Should Know about English Writing Skills» by Teresa F. Glazier.)

Mini-Test

Just relax! No test in the Unit.

Unit Three

Exercise I. Pronounce the following words

atmosphere
nickel
layer
iron
dangerous
core
giant
volcano
crust
earthquake
solid
equator
surface
current

Text A

OUR PLANET

Keywords: *earthquakes, carving, Grand Canyon, inner core, outer core, mantle, crust, atmoshere, equator, volcanoes.*

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

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

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

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

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

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

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

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

Oceans and seas cover almost 75% of the planet. Their powerful currents spread the sun's heat around the planet. This keeps the temperature from getting too hot or too cold. Water makes life possible. The earth's crust is composed of minerals and rocks, and is the source of all the nonrenewable resources we use, such as fossil fuels and minerals.

A mineral is a naturally occurring inorganic solid with a particular chemical composition and a crystalline internal structure. Some minerals consist of a single element, such as gold, silver, diamond (carbon), and sulphur.

However, most of the more than 2,000 identified minerals occur as inorganic compounds of the ten elements. A rock is a combination or aggregate of minerals.

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

VOCABULARY AND COMPREHENSION

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

1. What metals is inner core made of?
2. What moves around the inner core?
3. What does this motion cause?
4. What does the movement of mantle cause?
5. What role does the atmosphere play?
6. What keeps the temperature from getting too hot or too cold?

Exercise III. Guess the terms of the following definitions.

- central or most important part of anything;
- overall cover;
- piece of iron able to attract iron;
- hard surface;
- mixture of gases surrounding the earth; the air in a particular place;
- imaginary line drawn on maps, to represent points at an equal distance from the north and south poles.

Exercise IV. Choose the words, which are synonymous to the initial ones.

To change	**To happen**	**To move**	**To call**
to alter	**to mix**	**to change position**	**to develop**
to understand	**to occur**	**to breathe**	**to note**
to examine	**to hold**	**to keep**	**to term**
to explore	**to make**	**to cause**	**to name**

Exercise V. Choose the words that best complete the statements.

Rocks have _____ different colours, shapes, and textures.

a) many
b) few

Minerals are natural _____materials like diamond, quarts, and salt.

a) solid
b) liquid

Scientists who study rocks are called_____ .

a) chemists

b) geologists

Rocks deep inside Earth melt to form _____ rock.

a) solid

b) liquid

Water and wind _____ shape rocks.

a) slowly

b) quickly

Exercise VI. Determine whether each of the following statements is true or false.

1. Each rock doesn't tell geologists about its past. 2. Tiny pieces of rock scatter and settle in layers with sand, soil, seashells, dead plants, and animal skeletons. 3. Two rocks from the same category (igneous, sedimentary, and metamorphic) always look alike. 4. Any rock that has a fossil in it is most likely sedimentary.

Exercise VII. Choose the one word that best sentence.

1. The text «Planet» will help students ***gain*** new knowledge about Earth's processes.
   a) take
   b) make
   c) receive
   d) get
2. Reading the text you will ***discover*** some amazing features of the planet.
   a) find
   b) open
   c) effect
3. see500 million years ago first animals with backbones ***appeared.***
   a) closed
   b) arrived
   c) effected
   d) removed
4. 80 million years ago Rocky Mountains ***started*** to form.
   a) became
   b) defined
   c) began
   d) completed
5. 4.5 billion ago Earth ***formed*** from cosmic dust.
   a) came into existence
   b) melted
   c) used
   d) found

WORD-BUILDING

Exercise IX. Form verbs from the following adjectives by adding suffixes:

-en: hard, weak, deep, soft;
-fy: identical, simple, intense;
-ise: special, real, crystal, general.

Exercise X. Form the opposite of the following words by using prefixes:

de-: to form, increase, compose; dis-: to connect, order, like; in-: capable, different, essential; im-:'possible, probable, practical, proper, un-: able, certain, common, known.

Exercise XII. Study the list of some minerals. Notice the way their names are formed What suffix seems to work hard to coin them?

Augite, biotite, calcite, chalcopyrite, chlorite, copper, dolomite, fluorite, galena, garnet, graphite, gypsum, halite, hematite, kaolinite, kyanite, limonite, magnetite, muscovite, olivine, feldspar, pyrite, quartz, sulphur, talc.

Text B

WHERE DO MINERALS GET THEIR NAMES?

The familiar ending *ite,* used with most mineral names, goes back to ancient times. In the forms of *ites* and *ids* it was added by the Greeks, and later Romans, to ordinary words that denote qualities, uses, constituents, or localities of minerals and rocks. Thus siderites (now siderite) was made from the word for iron because the mineral contains iron, hematites (hematite) was made from the word for blood because of the red color of the mineral when powdered. All the present kinds of mineral names, except names for persons, were used in classical days.

Other terminations were used less extensively, though they include some of the most attractive-sounding mineral names. The ending *ine* appears in olivine, tourmaline, and nepheline, *ane,* in cymophane, *ase* in dioptase, enclase, and orthoclase, *yre* in dipryre, *ote* in epidote and glau- codote, *ole* in amphiobole, *aste* in pleonaste, *age* in diallage, *ore* in chlihochlore, diapore and pyrochlore.

Some of the most common mineral names are so old that their origin is unknown or doubtful. These include quartz, zircon, beryl, galena, cinnabar, gypsum, corundum and tourmaline.

(Vietrova E. I. Scientific English Through Fiction and Scientific Literature. — K.: Vyscha Shkola, 1993.)

Text C

THE WORLD OF LIFE

The earth is populated by living organisms: the plants and animals. They live in a shallow zone, on and in the land, in the fresh waters, and in the salt waters. Living organisms exist on the earth only under certain physical conditions. They include the presence of (1) the chemical substances making up the bodies of animals and plants; (2) water; (3) an atmosphere containing oxygen; (4) energy from the sun; and (5) certain limits of temperature, usually about 0° to 50° C (32° to 122° F).

We can easily distinguish most kinds of living organisms from nonliving or inorganic matter - a tree or bird, or worm from rock. But this is not easy with some lowly forms of life.

The seed of a plant or the egg of an insect seem inert, but when placed under suitable conditions they will soon reveal its living nature.

Some important basic differences between living and nonliving things are as follows:

Form *and* size. Each sort of living thing or organism usually has a definite form and a characteristic size. Most of them are also arranged as distinct individuals. A whale or any common plant is recognized by such features. Nonliving materials usually vary in both size and form , but many crystals are quite constant in form.

Chemical composition. Living organisms are *composed* largely of four chemical elements: carbon (C), hydrogen (H), oxygen (O) and nitrogen (N) in various but definite proportions. These four occur with lesser amounts of calcium (Ca), phosphorus (P), sodium (Na), potassium (K), iron (Fe), copper (Cu), sulfur (S), chlorine (Ch)$_f$ etc. These elements form complex organic molecules. Together they make the living substance or protoplasm of the plant or animal. The same and other chemical elements occur in the much smaller molecules of nonliving minerals, rocks and soil.

Organization. Each organism is made up of micro¬scopic cells, which are formed as interrelated systems of organs for performing the various life processes. Any structural arrangement of rocks or minerals results from the nature of the constituent materials or the manner of formation.

Metabolism. With living organisms various essential processes, termed metabolism are constantly in progress. Nonliving things are relatively stable.

Irritability. Protoplasm and living organisms react to changes (stimuli) in the environment Stimuli may be external, such as heat, light, moisture or contact; or they may be internal. The degree of response often is not pro¬portionate to the stimulus. If nonliving materials react, there is definite quantitative relation between the amount of environmental change and the effect produced.

Reproduction. Each sort of living organisms has the ability to reproduce itself in kind - pine seeds . produce pine trees, not oaks; and the eggs of chickens produce chicks, not ducklings or rabbits. Nonliving things cannot reproduce.

Growth and life cycle. A living organism grows by development of new parts between or within older ones, and may replace parts during life. Each kind of organism has a definite life cycle', birth, growth, maturity and death. The nonliving things increase by external action.

GRAMMAR STRUCTURE

Plural of Nouns

Subject-Verb Agreement

Add -s or -es endings to form plural nouns: room + s = rooms, book + s = books, class + es = classes, box + es = boxes, pinch + es = pinches.

*Nouns with final **-o** become plural adding **-es:** hero/heroes, potato/potatoes. Notice plural forms of photo and piano: photos, pianos. Can you explain when we should add **-s** and when **-es** endings to form plural of nouns?*

Be alert of changing -y ending to -i while adding -es to the words of the following type: city/cities, duty/duties. You never do this with the words of «boy» or «toy» type: boys, toys. Can you guess what rule works here?

*Nouns with final **-f/-fe** become plural by changing **-f** into **-v** and adding **-es** ending: wife/wives, leaf/leaves. But: chief/chiefs, roof/roofs, safe/safes.*

1. *Remember the following.*

Singular	Plural
Man	Men
Woman	Women
Mouse	Mice
Tooth	Teeth
Foot	Feet
Goose	Geese
Child	Children
Ox	Oxen

2. Remember that the following words are always singular.

Information, news, advice, money, knowledge, hair, progress, vacation.
Names of sciences with the final *-ics* are singular too: genetics, physics.

2. Remember that the following words are always plural.

Scales (ваги), scissors (ножиці), spectacles, glasses (окуляри), pants, trousers (брюки), goods (товар), clothes (одежа), arms (зброя), jeans (джинси), shorts (шорти).

All parts of a sentence should agree. If the subject is singular, the verb should be singular too, if the subject is plural, the verb should be plural in general.

The following words must be followed by singular verbs in formal written English:

Any + singular noun, anybody, anyone, anything, nobody, no one, nothing, some + singular noun, somebody, someone, something, every, everybody, everyone, everything, each, either, neither.

***Either** and **neither** are singular if they are not combined with **or** and **nor.** When they are followed by **or** and **nor** the verb may be singular or plural depending on whether the noun following **or** and **nor** is singular or plural.*

***There is!are:** with sentences beginning with **there,** the subject is actually after the verb.*

1. There (is/are) tiny pieces of rock which scatter and settle in layers with sand, soil, dead plants and animal skeleton.
2. There (is/are) a rock with different types of mineral crystals in it.
3. (Is/are) there a rock with horizontal layers?
4. There (is/are) a lot of photos of mount Saint Helens, which were taken before, during and after the eruption.
5. Is there (is/are) different ways by which geologists predict eruption?
6. If there (is/are) an earthquake below a volcano, it may mean that pressure is building up.
7. There (is/are) at least three reasons why people live near volcano.

Exercise XIII. Translate the following sentences from English into Ukrainian.

1. No one of these species exists on this land, or, as far as is known, anywhere else in the word.
2. No one is saying that amino acids, if they really are extraterrestrial, were formed by living organism.
3. Everyone remembers that all cells have specialised roles over the entire range of diversity in biological form and function.
4. Some mixture of water vapour, methane, presumably initiated the secondary atmosphere.
5. Everyone has noticed the extraordinary effect upon insects when a passing cloud covers the sun.
6. Neither of these phenomena is discussed.

Exercise XIV. Choose the correct form of the verb.

1. His hair (need/needs) cutting. 2. Genetics (seem/seems) to be the science of the 21st century. 3. Your news (is/are) very important. 4. Such shorts (is/are) in fashion now. 5. The pants you bought yesterday (is/are) too expensive. 6. Your advice (help/helps) us a lot. 7. New analytical scales (was/were) installed in our laboratory. 8. Winter vacation at the university (last/lasts) a fortnight. 9. Their clothes (need/needs) to be cleaned. 10. Some people believe that money (keep/keeps) the world going.

Exercise XV. Complete the following sentences using tag questions.

The Earth was formed 4.5 billion years ago, .. ? The outer core is a liquid layer made of iron and nickel, .. ? The atmosphere is the layer of the air we breathe, .. ? The Earth's crust is 22 miles thick, .. ? The Earth history does not take place in one day, .. ? The mantle is not soft, .. ? The atmospheric changes do not cause volcanoes,.. ? The ground is not stilling beneath our feet,.. ? The dinosaurs do not appear before 200 million years ago,.. ?

SCIENTIFIC COMMUNICATION

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

A MIGHTY MAGMA MYSTERY

For over 120 years, Mount Saint Helens, a beautiful snow-covered peak in Washington State, remained calm. Then on May 18,1980, people heard a loud explosion as hot rock, gas, andash shot in the air. Mount Saint Helens, (сплячий), but active volcano had «woken up» and became an (діючим) volcano.

Hot molten rock, called magma, forced its way up into volcano exploded out of peak and side. In just a few hours, the area surrounding the volcano had radically (змінилася).

Exercise XVII. Write how you can predict a volcanic eruption. Use the following words and word combinations.

Predict eruptions, to study earthquake, beneath or near active volcanoes, pressure is building up, the volcano's peak, to fill up with magma, the angles of the slopes, like a balloon.

Exercise XVIII. Write an essay on why some people live near volcanoes, if they can be so dangerous. At least three reasons should be mentioned.

Exercise XIX. Now have some fun performing an Earthquake Shake.

The planet's crust is broken Into huge, gigantic plates.
The planet creeps on the mantle,
As the mantle circulates.
At the edge of plates are fault zones,
Where plates collide and slide.
When the plates get stuck,
The pressure builds —
Till something gives inside.
Then Earth shakes!
The ground quakes!
The shock waves travel far.
Each fault moves 1 of 3 ways,
And here is what they are.
If the plates slide past each other And
move hor-i-zon-tal-ly,
You've got yourself a strike-slip-fault.
Now try it here with me!

Write out the names of all the geological processes, mentioned in the text.

Exercise XX. Use the words and phrases supplied below to make extensive answers to the questions.

1. What do scientists use to measure earthquakes? (a tool, seismometer, to sense the vibration). 2. What is seismograph? (a machine, to draw pictures, earthquake's movement). 3. What is the picture made with a seismograph called? (to shake, the pen in a seismograph, to move back and forth, piece of paper). 4. What is a scientist who studies earthquakes called? («seismos» — the Greek word for the earthquakes). 5. On what scale do scientists measure the amount of energy that's released during an earthquake? (Richter).

Exercise XXI. Say which of the statements is correct.

1. Inside the earth on which we live there are gases and red-hot rock under high pressure. 2. Inside the earth on which we live there are gases and red-hot rock under low pressure.

1. When red-hot rock and pressing gases are violently out through the mouth of a volcano, they make a narrow shaft inside the volcano. 2. When red-hot rock and pressing gases are thrown violently out through the mouth of the volcano, they make a wide shaft inside of the volcano.

1. When people build a town in such a place, they try not to build too close to the mouth of the volcano. 2. When people build a town in such a place, they try to build too close to the mouth of the volcano.

1. Grand Canyon in Arizona was not built by man, it was «built» by nature. 2. Grand Canyon was built by man.

Exercise XXII. Transform short information given below into an extended description of coral reefs.

Most islands are tops of mountains rising from the seabed. However in the warm waters around the equator, there are chains of small islands that were formed in very different way. These islands are chains of reefs...

Exercise XXIII. Discuss the following text. Supply additional information on the earthquake history in your country.

WHAT CAUSES EARTHQUAKES?

Earth's rocky crust is broken into about ten giant masses of rock, called plates, which move slowly on the mantle below. When the plates bump against each other or split apart, they break along cracks called faults.

Movement along faults is sometimes smooth. But other times, the rocks on each side of the fault get stuck. Over time pressure builds arid builds until the rocks are forced apart. This releases powerful shock waves underground. When these shock waves reach the surface, we feel earthquake.

Scientists know where many of Earth's faults are, so they can often predict where earthquakes will happen.

Unfortunately, they cannot predict exactly when they will occur.

Be ready to answer the following questions.

1. Into how many giant masses of rock is earth's rocky crust broken? 2. When do plates break along cracks, called faults? 3. Is movement along faults smooth? 4. What process releases the powerful shock waves underground? 5. What do we feel when these shock waves reach the surface? 6. Can scientists predict where earthquakes will happen?

Exercise XXIV. The author is primarily concerned with:

a) describing the work of a seismograph;
b) describing how to measure an earthquake;
c) describing the 1989 San Francisco earthquake;
d) describing the causes of earthquakes.

Exercise XXV. *All of the following can be found in the text except:*

a) Earth's rocky crust is broken into about ten giant masses of rock, called plates;
b) When the plates bump against each other or split apart they break along cracks called faults;
c) To measure earthquakes scientists use a tool called seismometer.

Exercise XXVI. Which of the following is not mentioned in the text?

a) Geologists sort rocks into three categories, based on how they were formed — igneous, sedimentary, and metamorphic;
b) Each rock tells geologists about its past;
c) How the ocean affects the climate around the world;
d) Scientists can often predict where earthquakes will happen.

Exercise XXVII. Read and discuss.

Oceans affect the climate around the world. Climate is the typical weather pattern for a certain area of the world. Near the Equator, for example, the climate is very hot all year. Near the North Pole, the climate is always bitter cold. The change of seasons affects climate. Another thing that can change the climate is EL Nino. EL Nino is a major change in climate that happens every 2 to 7 years in the Pacific Ocean near the Equator. Normally, the climates of the western and eastern Pacific Ocean are very different. During an EL Nino year, the patterns almost reverse.

The name EL Nino appeared many years ago, when fishermen from Peru noticed that the Pacific Ocean often became warmer around Christmas. So they nicknamed this change «EL Nino» which is Spanish for «Christ child».

Exercise XXVIII. Geology quiz «Do you know our planet?»

The Earth formed from dust (4.5/3) billion years ago.
The oldest rock ever found is (5/3.96) billion years old.
First animals with backbones appeared (500/100) million years ago.
The age of dinosaurs began (50/190) years ago.
Rocky Mountains started to form (10/80) million years ago.
Earliest humans appeared (1.8/3) million years ago.
Humans began using fire (750/150) thousand years ago.

Answers: *4.5 billion, 3.96 billion, 500 million, 190 million, 80 million, 1.8 million, 159 thousand years ago.*

Exercise XXIX. Now back to your application letters and CVs. Decide where you would normally give this info: in your CV, in your letter of application or in the application form.

1. Your name, address and telephone number.
2. The date of birth.
3. Your marital status.

4. The name and address of present or last employer.
5. Your hobbies.
6. The sports you play.
7. Details of all the jobs you had.
8. The languages you speak, read or write.
9. Details of exams you passed at school.
10. Details of diplomas and degrees.
11. Details of your achievements in studies and career.
12. Your reasons for applying for the job.
13. When you are available for interview.
14. Details of your present job.
15. Your current or last salary.
16. The salary you would like to receive.
17. The names and addresses of three referees.

Exercise XXX. Now it's time to produce your own curriculum vitae. Work in pairs to discuss what your own CV will include. Make notes. Draft your CV and read it in the class. The trick is to present you in the best possible light without wasting potential reader's time.

Supplementary text

FOREIGN EDUCATIONAL ENVIRONMENT: SCHOLASTIC ACHIEVEMENTS AND OTHER AWARDS

Universities normally recognize and reward students who attain academic excellence in many ways. Academic superiority is recognized through the Dean's Honour List, through graduation honours and through honourary societies.

Superior academic performance is recognized at the end of the fall and spring terms and summer sessions by the Dean's Honour List (Roll), which lists all students who received 3.6 average in courses taken during the term.

High academic achievement is recognized by graduation with honours: cum laude (3.5), magna cum laude (3.7) and summa cum laude (3.9). Honours are limited to the top 15 percent of the graduation class with a maximum of 3 percent for summa cum laude, 5 percent for magna cum laude, and 7 percent for cum laude.

There are several national honourary societies in the USA where membership is open to students whose grade point average places them in the top 5-10 percent of their class. Beta Gamma Sigma, the honourary society for the students of business, has 119 chapters throughout the country. The comparable honour society in the humanities is called Phi Beta Kappa. Adult students continuing their education have their own national honour society named Alpha Sigma Lambda. Alpha Lambda Delta honours academic excellence of freshmen and Beta Beta Beta is the national honour society for students of biological sciences.

There are a lot of so called Greek organizations (honourary, professional, and recreational) in US universities, that coin their names using letters of Greek alphabet. These societies, Fraternities for men and Sonorities for women, use the language of their own to describe their activity. A graduate member of the Fraternity is called alumnus (plural: alumni), while in the Sonority these names are alumna and alumnae.

Mini-Test

1. Write 10 keywords of the text.
2. Write English equivalents of the following word combinations: деякі зміни, поверхня сонця, небезпечні промені, земна кора, гірська порода.
3. Give synonyms to the following words: outer, interior, hot, giant, measure, solid, core, change, liquid, dangerous.

4. Give antonyms to the following phrases: outer shell, thin layer, to change all the time, a solid rock, hot surface.

5. Write the definitions of: mantle, earthquake, atmosphere, ocean.

6. Make verbs agree with their subjects.

a) There (to be) many theories about the origin of life on the Earth; b) Another of my friends (to study) geology; c) Everyone in the family (to enjoy) travelling; d) Neither of the hypotheses (to be) substantiated.

7. Write three forms of ten irregular verbs. Check the list of irregular verbs in the dictionary.

Unit Four

Exercise I. Pronounce the following words:

different
matter
define
characteristics
classify
category
identify
solid
liquid
gas
mixtures
constancy
component
element
pure
electricity
reversible
tear
dioxide
flexibility
brittleness
flammability
explosive
power

Exercise II. Pronounce the following word combinations:

chemical change
chemical characteristic
constant composition
fixed shape
definite volume
pure substance

Text A

FUNDAMENTAL CONCEPT OF SCIENCE: MATTER AND ITS CLASSIFICATION

Keywords: *matter, substance, liquid, solid, gas, element, compound, mixture, physical state, chemical and physical changes.*

Anything that has mass and takes up space is matter. The world around us is an unlimited number of different forms of matter (from Latin materia meaning *material),* which can be defined by two characteristics: space and mass. Matter is classified in a surprisingly small number of categories, i. e. all samples can be identified as solids, liquids or gases. Solids have fixed shape and definite volume, they don't tend to diffuse and can melt or sublime (to sublime means to go directly to a vapour or gas from the solid state). Liquids flow and can be poured from one container to another, taking on their shapes. They are characterised by definite volume and indefinite shape. Liquids evaporate, many of them at room temperature, diffuse (or mix) slowly and are incompressible. Gases have no definite shape or definite volume, they are compressible and diffuse readily. This is the classification of matter according to physical state.

The classification into two broad categories: pure substances and mixtures, based on the constancy of composition is more useful to chemists. Pure substances have a constant composition. Mixtures, on the other hand, display varying properties with the variation of the component proportions. Elements and compounds are pure substances. Element is a pure substance which cannot be broken into simple substances by ordinary chemical changes.

Most matter exists as compounds — combinations of atoms, or oppositely charged ions, of two or more different elements held together in fixed proportions by attractive forces called chemical bonds.

Compound is a pure substance, which can be broken into simpler substances (elements) by ordinary chemical changes. They are composed of two or more elements combined in a fixed proportion. Mixture, on the other hand, is a combination of two or more pure substances, which can be separated by a mere physical change. Elements can be called the simplest substances, the building blocks from wfuch all other matter is made up by various combinations. There are only 106 elements, whereas the number of compounds and mixtures is unlimited. Each element has a symbol and all of them are classified as either metals or non-metals. Elements, which are classified as metals, can conduct electricity and bend without breaking. Non-metals lack lustre, do not conduct electricity and are brittle.

All materials can undergo physical and chemical changes. A physical change does not result in a formation of a new substance. They are reversible. All changes in state are physical changes and familiar examples are: freezing water, mixing together pure substances, tearing, into pieces, etc. In contrast, chemical changes produce a change in nature or composition of pure substances.

During chemical changes new pure substances with new chemical properties are always produced. Common example is burning solid coal, which results in the formation of a gas carbon dioxide. All pure substances can be identified on the basis of chemical and physical properties. Size, colour, taste, odour, state, ability to conduct electricity, flexibility, brittleness are physical properties, while flammability, rusting, explosive power are familiar examples of chemical characteristics.

VOCABULARY AND COMPREHENSION

Exercise III. Answer the following questions.

1. What are the major forms of matter? 2. How is matter classified according to physical state? 3. How is matter classified according to constancy of composition? 4. What is the difference between pure substances and mixtures? 5. How are pure substances identified? 6. What are physical changes? 7. Why do physical changes not result in a new substance formation? 8. What are chemical changes of matter? 9. What makes matter useful to us as a resource? 10. What are the major forms of energy? 11. How can we waste less energy? 12. What scientific laws govern changes of matter from one physical or chemical form to another?

Exercise IV. In what paragraph do you find the answer?

1. What is the origin of the word matter?
2. What shape and volume do liquids have?
3. What is sublimation?
4. How do elements form compounds?
5. How do you separate parts of mixtures?

Exercise V. Study keywords and their definitions.

Matter	-	what a thing is made of, material.
Property	-	any identifying characteristic of a substance.
Liquid	-	readily flowing, fluid.
Solid	-	firm or compact, neither liquid nor gaseous.
Element	-	any substance that can not be separated except by nuclear disintegration, basic part.
Compound	-	a substance composed of two or more elements chemically combined.
Mixture	-	matter that is combined physically and in no set amounts.

Exercise VI. *Find in the text and write down definitions of the following terms.*

Chemical change, diffusion, pure substance, physical change, and sublimation.

Exercise VII. Match English terms of column B with their Ukrainian equivalents of column A.

A	**B**
Випаровувати(ся)	**Mix**
Змішувати(ся)	**Melt**
Плавити(ся)	**Evaporate**
Охолоджувати(ся)	**Combine**
Сполучати(ся)	**Cool**
Сублімувати(ся)	**Sublime**
Тверднути	**Solidify**

Exercise VIII. Write English equivalents of the following word combinations.

Класифікувати речовини за фізичним станом, базуватися на сталості складу, виявляти мінливі властивості, зазнавати фізичних та хімічних змін, отримувати речовину з новими хімічними властивостями, проводити електричний струм, мати сталі об'єм та форму, випаровуватися при кімнатній температурі.

Exercise IX. From the following choose the word which is most nearly the same in meaning to the initial one.

Matter	**Liquid**	**Category**	**Property**
a) compound	a) water	a)concept	a)characteristic
b) substance	b) fluid	b)idea	b) classification
c) mixture	c)aqua	c) generalisation	c)feature
d) material	d) alcohol	d) class in classification	d) ingredient

Exercise X. *From the following choose the word which is most nearly opposite in meaning to the initial one*

.

Solid	Pure	Constant	Simple
a) soft	a) clean	a) permanent	a) mere
b) hard	b) impure	b) variable	b) mixed
c) **firm**	c) mixed	c) stable	c) complex
d) compact	d) liquid	d) definite	d) pure

Exercise XI. In each of the following related pairs find the item that best completes the comparison.

1. Element is to compound as:

a) liquid is to gas;
b) composition is to property;
c) compound is to matter.

2. Property is to conductivity as:

a) power is to energy;
b) metal is to matter;
c) matter is to substance.

Exercise XII. Translate the following sentences, paying attention to differem meanings of the words matter and volume.

Matter — матерія, речовина, матеріал, предмет, справа.

Volume — об'єм, маса, ємкість, сила, том (книга).

1. Matter makes the world around us. 2. Gaseous matter is well compressible. 3. What's the matter? 4. The matter is that we haven't got enough reagents for this experiment. 5. This is £ matter of life and death. 6. Students always define molecular volume of substance in this experiment. 7. Liquids have shape and fixed volume. 8. This device can be used to amplify the volumt of a sound. 9. There are a lot of rare volumes in our library. 10. Chemistry studies matter and th« ways it changes. 11. Volume of gases is always definite.

Exercise XIII. Open the brackets and choose the correct word to make the sentence true.

1. Mixtures are made by (chemical, physical) changes. 2. (Melting, burning) is a chemica process. 3. Compounds and elements are (pure, impure) substances. 4. Size, colour, taste anc odour are examples of (physical, chemical) properties. 5. The classification of matter according tc the constancy of composition is based on (state, purity) of substances. 6. Ability to conduct elec tricity characterises (metallic, non-metallic) elements. 7. Chemical changes describe how a substance reacts to form new (states, kinds) of matter.

Exercise XIV. Change the underlined word to make the sentence true.

Liquids have definite shape and fixed volume. 2. The classification of matter into three state: is the classification according to chemical state. 3. Compounds can be called the simplest sub stances. 4. Physical change usually results in a new substance formation. 5. Burning solid coa usually results in carbon monoxide formation. 6. Explosive power is a familiar example of ; chemical state. 7. The ability of matter to change by burning is a physical property.

Exercise XV. Fill in the blank spaces in the table with synonymous words from scientific and everyday English.

Consult the dictionary.

Terminological	Everyday
	Fluid Clean Weight
Reactive Constancy Transform Inert	

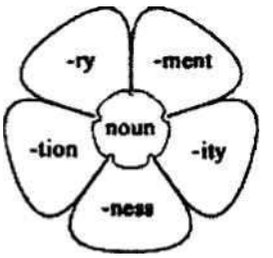
WORD-BUILDING

Exercise XVI. Use suffix -(a) tion to form nouns from the following verbs.
Classify, identify, purify, liquefy, solidify, certify, notify.

Exercise XVII. Translate the following sentences paying attention to the following derivatives.
Pure, purify, purification, purity, impurity.

1. All compounds are pure substances.
2. Special devices are used to purify metals.
3. After purification water can be used for drinking.
4. Analysts usually obtain substances of high purity.
5. In quantitative analysis radiation is used to detect very small impurities in various materials.

Study the «word-flower» to familiarise with some noun forming suffixes.



Exercise XVIII. Use suffix -al to make adjectives from the following nouns. Consult the dictionary.

Model: form + al = formal.

Chemistry, physics, identity, analysis, proportion, element, electricity, nature.

Use suffix -ly to transform the newly made adjectives into adverbs.

Model: formal +ly = formally.

Exercise XIX. Make terminological word combinations with the adjectives of Exercise XVIII and the words below.
Analysis, change, characteristic, property, chemistry, ratio, composition, current, compound.

Text B

CLOSED ECOLOGICAL SYSTEMS, SPACE LIFE SUPPORT AND BIOSPHERICS

For its more than thirty year long history, the experimental creation of closed ecological systems has from its very sources been distinctly and strongly motivated by the development of human life-support systems for space. As the trend developed its fundamental significance and broad opportunities of terrestrial applications of the technologies under development were coming to the foreground. Nowadays, it can be argued that development of closed ecosystems is experimental foundation of a new branch of ecology biospherics, the goal of which is to comprehend the regularities of existence of the biosphere as a unique in the Universe (in that part of it that we know, at least) closed ecosystem. Closed technologies can be implemented in life-support systems under adverse conditions of life on the Earth - in Arctic and Antarctic latitudes, deserts, high mountains or deep in the ocean, as well as under the conditions of polluted water and air. In space where the environment is hostile for life all around the cell of life should be sealed and the life-support system as close to the ideally closed cyclic turnover of the matter as possible. Under terrestrial conditions designers should strive for maximum closure of the limiting factor: water - in deserts, oxygen - in high mountains, energy - in polar latitudes, etc. Essential closure of a life-support systems withstands also pollution of the environment by the wastes of human vital activity. This is of particular importance for the quarantine of visited planets, and on the Earth under the conditions of deficient heat in high latitudes and water in and areas. The report describes experimental ecosystem 'BIOS' and exohabitats being designed on its basis, which are adapted to various conditions, described capacities of the Center for Closed Ecosystems in Drasnoyarsk for international collaboration in research and education in this field.

Closed ecological systems have had a number of applications within the past 50 years. They are unique tools for investigating fundamental processes and interactions of ecosystems. They also hold the potentiality for creating life support systems for space exploration and habitation outside of Earth's biosphere.

Finally, they are an experimental method of working with small "biospheric systems" to gain insight into the functioning of Earth's biosphere. The chapter reviews the terminology of the field, the history and current work on closed ecological systems, bioregenerative space life support and biospherics in Japan, Europe, Russia, and the United States where they have been most developed. These projects include the Bios experiments in Russia, the Closed Ecological Experiment Facility in Japan, the Biosphere 2 project in Arizona, the MELiSSA program of the European Space Agency as well as fundamental work in the field by NASA and other space agencies. The challenges of achieving full closure, and of recycling air and water and producing high production crops for such systems are discussed, with examples of different approaches being used to solve these problems. The implications for creating sustainable technologies for our Earth's environment are also illustrated.

GRAMMAR STRUCTURE

Review of Contractions and Possessives
Review of Simple Tenses. Active versus Passive
Cardinal Numerals

Two words condensed into one are called a contraction: ***do no = don't.***
The apostrophe goes in the exact place where the letters are left out:

I am	**I'm**
I have	**I've**
I shall	**I'll**
I will	**I'll**
I would	**I'd**
You are	**You're**
You have	**You've**
We are	**We're**
We have	**We've**
They are	**They're**
Are not	**Aren't**
Cannot	**Can't**
Have not	**Haven't**
Let us	**Let's**
Who is	**Who's**
Who has	**Who's**
Where is	**Where's**

There is one trick which always works in writing possessives. This trick is to ask yourself the question: ***Who or what does it belong to? Or older usage Whom does it belong? or To whom does it belong?*** *If the answer ends in* ***s,*** *just add an apostrophe.*

If it doesn't end in ***s,*** *add an apostrophe and* ***s.***

Practice and put apostrophe in each possessive.

A red foxs method of keeping warm while sleeping is to wrap its tail around its head as a muff.
For coping with winters chills, animals and birds have some interesting mechanisms.
A cardinals feathers are fluffed out to reduce heat loss.
A soft undercoat of fine hair serves as a deers thermal underwear.
One of the few woodland creatures able to thrive during winters worst weather is the chickadee.
A hares snowshoes are more than an inch thick and provide warm overshoes.

Present and Future Simple Tenses

(active and passive forms in comparison)

	Present Simple	**Future Simple**
Active	**change** **changes**	**shall** **change** **will**
Passive	**am** **is changed** **are**	**shall** **be changed** **will**

Positive, Negative and Interrogative Phrases in Present Simple (active versus passive)

	Phrases in Present Tense (active)	**Phrases in Present Tense** (passive)
Positive	I (you, we, they) change temperature He (she, it) changes temperature	Temperature is changed by me (you, us, them) Temperature is changed by him (her, it)
Negative	I (you, we, they) do not change temperature He (she, it) does not change temperaure	Temperature is not changed by me (you, us, them) Temperature is not changed by him (her, it)
Interrogative	Do I (you, we, they) change temperature? Does he (she, it) change temperature?	Is temperature changed by me (you, us, them)?

	Phrases in Present Tense (active)	**Phrases in Present Tense (passive)**
Positive	I (you, we, they) change temperature He (she, it) changes temperature	Temperature is changed by me (you, us, them) Temperature is changed by him (her, it)
Negative	I (you, we, they) do not change temperature He (she, it) does not change temperaure	Temperature is not changed by me (you, us, them) Temperature is not changed by him (her, it)
Interrogative	Do I (you, we, they) change temperature? Does he (she, it) change temperature?	Is temperature changed by me (you, us, them)? Is temperatuie changed by him (her, it)?

Please, be aware of the fact that in the active voice, the subject of the sentence does the action; in the passive, the subject receives the action. Although the active voice is simpler, more direct and less wordy, passive constructions are appropriate in Scientific English, where we wish to emphasise the receiver of the action or to minimise the importance of the doer. To transform a sentence from the passive to the active voice, make the actor the subject of the sentence.

Go ahead and compose the Table of the Past Simple Passive Forms.

It goes without saying that you should know English numerals for your future professional activity: one (1), two (2), three (3), four (4), five (5), six (6), seven (7), eight (8), nine (9), ten (10), eleven (11), twelve (12), thirteen (13), fourteen (14), fifteen (15), sixteen (16), seventeen (17), eighteen (18), nineteen (19), twenty (20), twenty-one (21), twenty-two (22), etc., thirty (30), forty (40), fifty (50), sixty (60), seventy (70), eighty (80), ninety (90), a hundred (100), a hundred and one (101), etc., two hundred (200), three hundred (300), etc., a thousand (1,000), a thousand and one (1,001), a thousand and two (1,002), a thousand three hundred and fifty four (1,354), two thousand (2,000), three thousand (3,000), etc., a million (1,000,000), a billion (1,000,000,000) (Am.) or a milliard in UK. Remember? Okay, these are cardinal numerals that enable you to answer the «How many» question.

Some tips to use cardinal numerals properly.

- *never use -s ending with hundred, thousand and million preceded by other numerals: e.g. five hundred*
- *never use -s ending with per cent (%): e.g. 30% (thirty per cent).*
- *use **commas** to separate categories of the numeral: e.g.1,876,001.*
- *use **and** in compound numerals: e.g. one hundred and twenty, one hundred and five.*

- *use **cardinal** numerals to denote years: two thousand (2000), nineteen hundred (1900), nineteen ninety one or nineteen hundred and ninety one (1991).*

Exercise XX. Change the following sentences from the passive to the active voice.

Carbon dating is used by scientists to determine the approximate age of objects. It can be concluded that a college education provides a significant economic advantage. Any matter, such as water, can be found in three physical forms. It was noted that 101 elements that occur naturally on the earth are distinctive forms of matter. All atoms are made up of even smaller subatomic particles: protons, neutrons, and electrons. Isotopes of the same element are identified by adding the mass number to the name or the symbol of the element. Carbon is contained in all organic compounds. It was learned from the test that the substance had a high biological activity.

Exercise XXI. *Make up the table of positive, negative and interrogative phrases in the Future Simple Tense (active and passive).*

Exercise XXII. Remember: passive constructions are usually associated with the impersonal style in scientific writing. Drop the subjects as unimportant and make the following sentences passive.

1. You establish electric conductivity.
2. I examine their chemical changes.
3. He compares metals with non-metals.
4. She studies crystalline structure.
5. We heat crystals.
6. We study properties of metals.
7. They observe metallic lustre.
8. We use crucibles.

Now change the sequence of the sentences to logically describe the procedure of studying metal properties.

Exercise XXIII. «By» or «With»? Insert the correct preposition. Remember: «By» combines with a doer while «with» — with a helping tool.

Substances are mixed together ... a chemist.
Substances are mixed together ... a stirrer.
Liquid is filtered ... a fdter paper.
Liquid is filtered ... a researcher.
Parts of a mixture are separated ... a magnet.
Parts of a mixture are separated ... an analyst.

Exercise XXIV. Identify one underlined word that must be changed to make the sentence grammatically correct:

1. New names of elements <u>is suggested</u> by the Ukrainian National Committee in Terminology. 2. All pure substances <u>are characterizing bv</u> the constancy of composition. 3. <u>The</u> simplest part of any substance are called an atom. 4. Atomic theory is studied <u>with</u> all students of chemistry. 5. Examples nf physical and chemical changes <u>shall</u> be <u>given</u> in number. 6. The distinction <u>between</u> inorganic and organic substances <u>are discussed</u> by many scientists. 7. <u>Some</u> properties of liquids <u>will</u> be <u>discussing</u> at our seminar.

Exercise XXV. Translate the following sentences into English using passive constructions.

1. Всесвіт складається з матерії та випромінювання.
2. Різні види матерії звуться речовинами.
3. Величина маси, яка пов'язана з певною кількістю енергії, визначається за рівнянням Ейнштейна.
4. Раніше вчені користувалися двома законами: законом збереження маси та законом збереження енергії.
5. Сьогодні ці закони зведені в єдиний закон збереження маси.
6. Властивості, що характеризують здатність речовини брати участь у хімічних реакціях, звуться хімічними властивостями.

Exercise XXVI. *Rewrite the following passage in the passive.*

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.

Exercise XXVII. Open the brackets and choose the correct form of the verb.

1. Chemists (study, studies) substances, their properties and transformations. 2. The classification of matter into liquids, solids and gases (is, are) based on the physical state. 3. Pure substance always (have, has) constant composition. 4. Chemical properties (includes, include) reactivity, flammability, rusting, explosive power and some other characteristics. 5. Chemical change (shall/will produce) a change in nature of pure substances. 6. Temperature often (shall/will influence) colour of a solution. 7. To identify a substance physical properties (is, are) often used.

Exercise XXVIII. In the passage given below some sentences are false. Make them negative for the text to be true.

The material, which has substance and takes up space, is matter. It can exist in three forms: solid, liquid and gas. Solids have definite volume. Their shape depends upon the shape of their container. Liquids are characterised by definite shape. Liquids always take the shape of the vessel into which they are put. Pressure has a great effect on their volume. Gases have no fixed volume or shape. They are readily compressible. Physical properties help to recognise forms of matter. Chemical properties describe colour, density and hardness of a substance.

Exercise XXIX. Rewrite the following sentences, substituting each underlined subject by an appropriate pronoun and choosing the correct verb in brackets.

1. Chemistry (study, studies) matter and its changes. 2. Chemical reactions (is, are) called chemical transformations. 3. Matter (is, are) not changed from one state into another unless energy is absorbed or released. 4. Scientists (know, knows) that matter can change from one form into another. 5. A chemist (uses, use) various techniques to state composition of a substance. 6. Chemical properties (describe, describes! how a substance reacts. 7. Odour and taste, (is, are) physical properties of a substance.

Exercise XXX. Write the questions to which the following sentences are possible answers.

Yes, it does. It studies matter and its transformations.
Yes, it is. It is one of fundamental sciences.
Yes, it does. It makes the world around us.

Yes, there are. There are two kinds of matter: organic and inorganic.
No, it is not. It is not the classification of matter according to a physical state.
Yes, they are. They are pure substances.
No, they do not. They do not break into simpler substances.

Exercise XXXI. Write about molecular structure of oxygen, ozone, iodine and sulphur using introductory there.

Model: *There are two atoms in hydrogen molecule.*

Exercise XXXII. *Rewrite the following passage in the Future Simple Tense.*

We examine suspensions before and after shaking. First we see that the liquid is cloudy. At the bottom of the bottle there is a layer of powdery solid. Then we shake the bottle. The solid at the bottom disappears and the liquid is evenly cloudy. No amount of stirring or shaking makes it clear. Light does not pass through the liquid. Suspended particles stop it. We call such liquids suspensions or liquid mixtures.

Exercise XXXIII. ***Write*** *the following in words.*

99; 128; 1,865; 6,000; 10,000; 5,032,654; 2%; 100%; year of 1986.

SCIENTIFIC COMMUNICATION

Exercise XXXIV. Insert missing words, and then state what properties of iodine are described in the passage.

Iodine is a non-metallic element of the seventh group of the Periodic Table. Its atomic ... is 53, atomic mass — 126.9. It is of halogen family. The ... of the element consists of two atoms. Iodine is the only solid halogen under normal conditions. It ... at 114°C and boils at 184°C. The pure iodine has crystalline ... and is a conductor of ... The element dark plates or granules readily sublime, are insoluble in water and ... in common solvents. Iodine is ... and very corrosive. Iodine is the most... member of the halogen family. The direct combination of iodine and phosphorus forms a spontaneous display of ... In a large evaporating dish carefully place very small ... of iodine. The mixture will suddenly ... into a brilliant flame, evolving large clouds of smoke.

Exercise XXXV. Translate the following text, in which physical properties of bromine are described.

Бром належить до сім'ї галогенів і знаходиться в 7-й групі Періодичної таблиці елементів. Молекула брому складається з двох атомів. Атомне число брому 35, атомна вага — 79.9. Це червоно-бура рідина з неприємним запахом, яка має температуру кипіння -58.7°C і плавиться при -7.3°C. Бром погано розчиняється у воді та міститься у невеликій кількості в морській воді.

Exercise XXXVI. Use the following plan to write a descriptive characteristic of chlorine.

1. Position in the Periodic Table.
2. Symbol of the element.
3. Molecular and atomic structures.
4. Physical state and properties.
5. Chemical properties.

Exercise XXXVII. Give descriptive characteristics of the following objects as mixtures or pure substances.

A. Coca-cola, silver, cocktail, bronze, blood, salt, soup.
B. Augite, calcite, chlorite, copper, pyrite, quartz, sulphur.

Exercise XXXVIIL Are the following statements examples of physical or chemical changes?

a) Salt is dissolved.
b) Food is digested.
c) Butter is sliced.
d) Water is decomposed.

Exercise XXXIX. Speak on the comparative characteristics of iodine and bromine. Use contrastive words and phrases: ***but, however, whereas, although, yet, while, in contrast to, on the other hand.***

EXAMPLE. Iodine boils at 184°C. Bromine boils at 58.7°C.
Iodine boils at 184°C, whereas bromine boils at 58.7°C.

a) Compare: state, colour, smell, melting and boiling points, solubility, sublimation, molecular structure, conductivity of the elements.
b) Compare: the shapes and volumes of the following solids, liquids and gases.

Exercise XL. Identify the keywords and topic sentences of the following text. To what field of science can it be related?

ANATOMY OF ELEMENT DISCOVERIES

There are 106 elements known, of which about 80 are stable and the rest are man-made radioactive ones. Of the stable ones, 60 are metals. These vary from gold, which is almost immune to chemical attack, to caesium, which explodes when dropped into water. The most common qualitative characteristic of any element is its chemical reactivity. Some elements are very active as fluorine; others are very inert like rare gases or noble metals. Gold, platinum, silver, mercury, copper, lead and tin open the history of the discovery of metals. The least active ones were the first to be discovered: the more reactive a metal was, the stronger its combination with other substances, and the more difficult it was to destroy this combination and to obtain a pure metal.

The order of the discovery of this or that element depends upon two factors: its reactivity and abundance in Nature. Priority of the factors changes with the development of technology: reactivity seems more important on early stages of civilisation, while in modem period its place is taken by abundance of the element.

Unfortunately, there are no strict regularities in the history of metals and non-metals, nevertheless all the exceptions found only prove the rule of the two factors: abundance and reactivity.

Exercise XLI. Speak on the fundamental concept of science.

Exercise XLII. Speak on the island of stability for radioactive elements.

Exercise XLII. Can the following conclusions be made upon reading the above text?

1. Electron structure of metals and non-metals is quite different.
2. Reactivity and abundance are two factors crucial for the discovery of elements.
3. Iron is the world's most useful metal, because it is not very sensitive to air and water.
4. Gold opens the history of metals discovery because it is the least reactive element.

Exercise XLIII. Can you imagine what new miraculous materials will be «cooked» by material scientists in nearest future? Speak on the subject upon reading the text below.

In the past 50 years, chemistry, physics, mineralogy and engineering melted into a new discipline called material science. Material scientists can often figure out how atoms and molecules should be arranged to meet our needs, and they mix as much material as we want at a price we can afford.

The success of it depends on developments in physics and chemistry. New analytic tools allow to explain how properties of substances depend on the arrangement of atoms and molecules, new fabrication techniques help to synthesise novel materials and new theoretical methods help investigators envision materials with wonderful characteristics: compounds harder than diamonds, for example.

Today, material scientists can't yet cook everything they imagine. Interestingly, history people often came up with new materials by chance. Phoenician sailors cooking on a sandy beach propped up a clay pot on a charred wood. Heat and organic wood, they noticed, turned the sand below into a translucent material that was mouldable, malleable when hot, and watertight when cool. Our thanks to ancients for glass! In the 19th century the hardware merchant Charles Goodyear mixed natural rubber with various substances to make it more flexible and durable. Then he accidentally spilled raw latex and sulphur on a hot stove, and the recipe for vulcanisation was ready.

So, how much promise is there in the material world of the future?

Supplementary text

FOREIGN EDUCATIONAL ENVIRONMENT: FRESHMAN PARENT DAY IN AMERICAN COLLEGES

Student's life is strictly regulated and administered in American colleges. Graduates of the Higher Education Administration schools are well prepared for leadership positions in colleges. They work in such structural divisions as Admission Office, Career Service Centre, Dean's Office, Bursar Office, Office of Registration, Housing Office, etc and form an effective network of supportive staff members ready to assist in such areas as admission, orientation, residence, student activities, financial aid and placement.

Freshman's Parent Day is organised by the Office of Student Life and is conducted in spring semester. Parents receive a letter of invitation from the Dean and the Faculty to come to the university. The staff members try to do their best in all the organisational details: schedule, accommodation, meals, driving directions, schematic map of buildings, parking lots and garages.

The Administration and the Faculty believe that the school and family can team up to give a student a support and resources needed to be a happy and productive member of the college community. Therefore, they do not spare their efforts to provide parents with useful info and offer insight into their son and daughter's experience at the college.

To check your understanding of the text, please, find the names of the departments and colleges that train specialists for higher educational administration; the names of college divisions in charge of financial aid, tuition fee, career planning, students' activities.

Do you agree that the university and the family should team up to help a student to become a productive and happy member of a college community? Use the following phrases to express your opinion: I am sure that, I am convinced that, I believe that, I quite agree, exactly, I disagree completely, I don't agree, of course not, that's ridiculous, that's out of the question.

Exercise XLIV. Restore questions to the following short texts.

The course «Curriculum in Higher Education» focuses on the principles of curriculum planning. It pays attention to moral development of students, ethics, cultural diversity and demographics.

The «Law and Higher Education» course emphasises legal environment of higher schools and problems in the administration of colleges.

The seminar «American College Student» offered an analysis of the American college student from demographic, psychological and cultural point of view. It overviewed growth and change during the college years.

Exercise XLV. Please find below a sample business letter. In writing business letters be direct, clear and courteous. But do not hesitate to be firm if necessary. Be concise to show that you value a reader's time.

If you decide to type a letter in a «block» style the return address should be at the top and lined up to be to the right of the centre of the page. The same for a signature at the bottom. The inside address, the salutation and the body of the letter are left. The paragraphs are not indented

121 Drewdrive,
7 College Park,
New York, NY
10011

Claudia Kalb, Managing Editor
Newsweek,
251 West 57th
Street New York,
NY 10019

Dear Ms. Kalb:

I am applying for the summer editorial internship you listed with the Career Service at the New York University. I am currently a junior at the NYU with a double major in English and Roman Languages Studies.

Over the past three years I gained considerable experience in newspaper and magazine journalism, as you will see on my enclosed CV. I am familiar with basic procedures of editing and photographic development, but my primary interests lie in feature writing and landscape photography. My professional goal is to work as a photojoumalist preferably for a major magazine. I cannot imagine a better introduction to that career than a summer at Newsweek.

I am available for an interview almost any time and can be reached at 000 000 000.

I look forward to hearing from you.

Sincerely, (signature)
Almiro Rodrigues

Remember: *your letter should be clear, concise, courteous and correct. Put separate ideas in separate paragraphs. Use short words and sentences to help a reader to understand you better. Plan your letter before writing it.*

Use the sample to compose your own letter to apply for a summer job.

Exercise XLVI. Notice some useful abbreviations used in letters and other documents.

in the U.S.A. and No in UK both mean «number»;
St., Rd., and Sq. are short for «street», «road» and «square»;
P.T.O., e.g. or eg, i.e. or ie, etc or etc. stand for «please, turn over», «for example», «that is» and «so on»;
Cf., do., viz. mean «compare», «ditto», «namely»;
C. c. at the end of a formal letter shows to whom a copy was sent;
Enc., or end. shows that a letter has some enclosure.

Mini-Test

1. Write 10 keywords of the Unit.

2. Write English equivalents of the following word combinations.
   Різні форми матерії, сталий склад, проводити електричний струм, мати певну форму та об'єм, переходити в газуватий стан, призвести до утворення рідини.

3. In what way do atoms of different elements differ?
   a) positive charge of nucleus;
   b) number of electrons;
   c) electroneutrality.

4. An atom contains seven protons, eight neutrons and seven electrons, write the symbol and the name of this atom.

5. Match the items on the left with the descriptions on the right.

	The molecule of the element consists of two atoms.
	At room temperature it is a solid substance with crystalline structure.
	Crystals have dark-blue colour and conduct electricity.
Iodine	Melting temperature is 960.5°C.
	The best known conductor of electricity under normal conditions.
Silver	A very soft metal with melting temperature of 1063°C.
	It is the third best conductor of electricity known after silver and copper.

6. Make the following sentences negative.
   a) The substance sublimes under normal conditions; b) Solid materials dissolve in all acids; c) Crystals of iodine are red; d) This metal has many uses.

7. Now write Yes — No questions to the above sentences.

8. Change the following sentences into passive.
   a) Industry produces great quantities of bromine.
   b) Chemists use the element in laboratory synthesis.
   c) Bromine will displace iodine.
   d) Bromine forms a yellow colour with starch.
   e) Starch bleaches bromine water.
   f) Seawater contains bromine salts.

   Open the brackets and translate the words into English.

9. Silicon after oxygen is the most common (елемент) on the Earth. It is a dark-brown (тверда речовина) with (кристалічною) structure. Silicon is (неметалічний) element with (атомним числом) 14 and atomic (вагою) 28. Its (сполуки) are present in all rocks. Silicon occurs in (чистому стані) as quartz. Silicon does not conduct (електричний струм).

10. Write three forms of ten irregular verbs. Check your accomplishment using the list of irregular verbs.

11. Receipt:

One glass of cream, 100 g of sugar, 100 g of fat or margarine, half-spoon of table salt, one glass of flour, *4*—5 eggs.

What can you cook from this?

Mini-Test Rating

Task number	Rating
1	**1000**
2	**1800**
3	**300**
4	**200**
5	**600**
6	**400**
7	**400**
8	**600**
9	**1200**
10	**1000**
11	**200**

Unit Five

Exercise I. Pronounce the following words:

mixture
kind
heterogeneous
distinct
phase
homogeneous
solution
dispersion
solvent
solute
absorb release
concentrate
converse
dilute
saturate
equilibrium
pressure
compressible
electrolyte
permit
current

Exercise II. Pronounce the following word combinations:

world of mixtures
distinct phase
solute particle
solution process
existing temperature
dissolved solid

Text A

SOLUTIONS

Keywords: *solution, component, dispersion, solvent, solute, solubility, heterogeneous, homogeneous, concentrate, dissolve, dilute, saturate.*

We live in the world of mixtures. Mixtures may be of two kinds: heterogeneous (those which consist of distinct phases, whose properties are well defined) and homogeneous (consisting of a single phase, whose properties are different from those of its components). Solution is a homogeneous mixture. In other words, a solution is a homogeneous dispersion of two or more kinds of substances. The substance, which is present in the largest amount is called the solvent, the substances present in smaller amounts are called solutes. The solvent and the solute may be a solid, a liquid or a gas. The solution process is rather complex and to understand its nature the following should be remembered.

1. Solute particles can separate from the crystal when enough energy is absorbed by them.
2. Solvent particles move apart and give space for the solute particles.
3. Solvent particles attract solute particles, and the energy is released.

The solution becomes more concentrated when we dissolve more solute in it. Conversely, when we dissolve less solute we shall have a dilute solution. A saturated solution is defined as a solution in which the solute is in equilibrium with the undissolved solid. A supersaturated solution is a solution, which has more solute than it could dissolve at the existing temperature. Increasing the temperature of the solvent we increase the solubility (if a solid dissolves endothermally).

Pressure does not affect greatly the solubility of solids and liquids because they are incompressible. Gases, on the contrary, are compressible and affected by pressure.

Some substances in solution called electrolytes conduct a current; others called non-electrolytes don't permit the current to flow. Solutions can be acidic, basic, or neutral. The chemist must have some means of determining whether a solution is acidic, basic, or neutral. Chemical indicators can serve this purpose. Essentially, an indicator is a dilute, weakly acidic solution that changes colour as the concentration of H_30^+ and OH" ions varies. Three indicators often used in laboratory work are litmus, methyl orange, and phenolphthalein. Litmus is an organic dye, which is derived from primitive plants called lichens. It is red in the presence of an acid and blue in the presence of a base. Methyl orange is an indicator which is yellow in basic solutions and red in acidic solutions. Phenolphthalein is colourless in acidic solutions and pink in basic solutions, unless they are very basic, when the indicator becomes colourless again.

VOCABULARY AND COMPREHENSION

Exercise III. Check your understanding of the text answering the following questions.

1. What kinds of mixtures do you know? 2. What is a heterogeneous mixture? 3. What is a homogeneous mixture? 4. What kind of mixture is solution? 5. What substance do we call a solvent? 6. What substance do we call a solute? 7. What must you know to understand the nature of the solution process? 8. When does the solution become more concentrated? 9. How is a saturated solution defmed? 10. How can you increase the solubility? 11. Does the pressure affect the solubility?

Exercise IV. In what line of the text do you read:

1) that mixtures may be of two kinds; 2) that a solution is a homogeneous mixture; 3) that the solvent and the solute may be a solid, a liquid or a gas; 4) that the solution becomes more concentrated when we dissolve more solute in it; 5) that pressure does not affect greatly the solubility of solids and liquids; 6) that gases are affected by the pressure; 7) that some substances conduct a current.

Exercise V. Note carefully definitions of each of the following words.

Mixture	- a mixture in which all of the parts are evenly,
Solution	or uniformly mixed.
Solute	- a substance which is dissolved.
Solvent	- a liquid in which something dissolves.
Dilute solution	- a weak solution that contains little solute.
Saturated solution	
Concentrated solution	- a solution which cannot hold any more solute at a definite temperature.

- matter that is combined physically.

Exercise VI. Write down the definitions of the following words.
Dispersion, solubility, component, equilibrium, current.

Exercise VII. Translate the following words and word combinations.

Solution - **ordinary solution, pure solution, dilute solution, saturated solution, water solution, liquid solution, concentrated solution, gaseous solution, conducting solution.**

Particle - **solvent particle, solute particle, dispersed particle, electrically charged particle, fundamental particle, indivisible particle.**

Temperature - **low temperature, high temperature, ordinary temperature, stated temperature, room temperature, the same temperature, standard temperature, constant temperature.**

Substance - **pure substance, poisonous substance, dangerous substance, certain substance.**

Property - **unique property, usual property, physical property, chemical property, individual property, characteristic property, explainable property.**

Exercise VIII. Write down all the actions chemists can do with:

1. Solution;
2. Solute;
3. Solvent;
4. Impurity;
5. Indicator.

Exercise IX. *Find Ukrainian equivalents to the following English word combinations.*

Kind of mixtures	Проводити струм
Distinct phase	Навпаки
In other words	Велика кількість
Large amount	Сильно впливати
Rather complex	Іншими словами
Move apart	Чітка фаза Досить
Affect greatly	складний
On the contrary	Віддалятися
Conduct a current	Різновид сумішей

Exercise X. From the following choose the word which is most nearly the same in meaning to the initial word.

- variety, class, view, set, material, member.
- various, difficult, obvious, definite, different, clear.
- sum, total, quantity, weight, foundation, board, agreement.
- the innate or essential qualities of a thing, force, class, basis, matter, organisation.

suck up, swallow up, reject, admit, accumulate.

Exercise XI. Translate the following sentences. Be sure that you know the meanings of the following words.

Rather — краще, швидше, досить, до деякої міри.
Rather... than — скоріше... ніж.

1. Some of the elements are rather common and well known but quite a lot are man-made. 2. It is much better to use liquid hydrogen rather than compressed gas. 3. Many of the very early ideas about the structure of matter were the result of thinking rather than of experimentation. 4. Possible solvents can be classified and, in turn, can be differentiated on the basis of a number of rather obvious properties. 5. Chemical formulas can be used rather than drawings of the atoms and molecules. 6. Usually, it is more useful to think of equations in terms of moles rather than molecules.

Exercise XII. Translate the following sentences. Mind the meanings of the words «solve» and «solution».

To solve — вирішувати, розчиняти.
Solution — вирішення, розчин.

1. Both pure substances and solutions are homogeneous. 2. In nature, solutions are much more common than pure substances. 3. The task of water purification in this region was finally solved. 4. This substance solves readily. 5. The solutions of many important questions in the field of environmental protection were fully approved. 6. Operations, such as distilling or freezing usually tend to separate solutions into pure substances that were the components of the solution.

Exercise XIII. Choose the one word that best keeps the meaning of the original sentence.

In our life we ***encounter*** mixture more frequently than any other type of matter.

a) examine c) discuss
b) meet with d) think of

It is convenient ***to refer to*** the parts of solution as the solvent and the solute.

a) ascribe c) limit
b) organise d) conduct

Solutions may ***be composed*** of any combination of the three physical states of matter.

a) be understood c) be dissociated
b) consist of d) be concentrated

The solution process ***is complex.***

a) evident c) apparent
b) complicate d) easy
d

We can ***increase*** the concentration of a solution by adding more solute.

a) decrease c) expand
b) make greater d) investigate

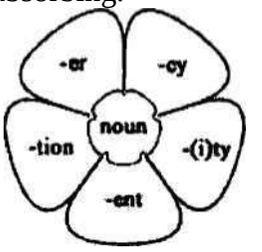
When we ***deal*** with gaseous solutions there is no limit to solubility.

a) handle c) discuss
b) examine d) mix

WORD-BUILDING

Exercise XIV. Translate the words of the same root. Then study the schematic «word-flower» of some noun-forming suffixes. Pick up the words from the list that are formed using these suffixes.

Solve, solute, solution, solubility, solvent, dissolve, solvable, solvation, solvency; separate, separability, separable, separating, separation, separative, separator, separatory; absorb, absorbability, absorbable, absorbency, absorbent, absorber, absorbing.



Exercise XV. Form the nouns from the adjectives by adding the suffix -(i)ty. Translate these nouns.

Soluble, active, able, possible, conductive, separable, clear, responsible, visible.

Exercise XVI. Form and translate new words using the suffix- ive.

Attract, distinct, affect, connect, illustrate, contract, protect, instruct.

Exercise XVII. Match adjectives of Column A and the nouns of Column B to make terminological phrases.

A	**B**
Heterogeneous	Phase
Distinct	Mixture
Homogeneous	Process
Complex	Dispersion
Incompressible	Gas
Compressible	Liquid

Exercise XVIII. Adverb/adjective choice.

1. This substance is _____ soluble in acids.
   weak or weakly
2. Water is to all living organisms.
   essential or essentially
3. The gas is toxic and should not be inhaled.
   high or highly
4. Silicon is never found in a _____ state.
   pure or purely
5. We need a solution for this experiment.
   neutral or neutrally
6. _____, this element occurs in a fixed state.
   natural or naturally **,** hydrogen is used in welding and reducing oxides of metals.
   industrial or industrially
7. Gases unlike liquids are_____ compressible.
   good or well

8. Water is used in _____ amounts for industrial needs.
large or largely

Text B

HEALTHY LIFESTYLE

Individuals are physically fit when they can meet both the ordinary and the unusual demands of daily life safely and effectively without being overly fatigued and still have energy left for leisure and recreational activities. Physical fitness can be classified into health-related and skill-related fitness. Health-related fitness has four components: cardiorespiratory endurance, muscular strength and endurance, muscular flexibility, and body composition. The components of skill-related fitness are agility, balance, coordination, power, reaction time, and speed. Skill-related fitness is crucial for success in sports and athletics, and it also contributes to wellness. Physical activity is any activity that you may do to improve or maintain your physical fitness as well as your health in general. It can include everyday activities (e.g. walking or cycling to work or school, doing housework, gardening or any active or manual work that you may do as part of your job); active recreational activities (dancing, active play amongst children, walking or cycling for recreation); sport (exercise and fitness training at a gym or during an exercise class, swimming and competitive sports such as football, rugby and tennis etc.). Adults should aim to do a mixture of aerobic activities and muscle-strengthening activities. Aerobic activities are any activity that makes your heart and lungs work harder. To gain health benefits, it is suggested that you should do at least 30 minutes of moderate intensity physical activity on most days of the week. 30 minutes is probably the minimum to gain health benefits. However, you do not have to do this all at once. For example, cycling to work and back for 15 minutes each way adds up to 30 minutes. Moderate intensity physical activity means that you get warm, mildly out of breath, and mildly sweaty. For example, brisk walking, jogging, swimming, cycling, dancing, badminton, tennis, etc. In addition to the above aerobic activities, adults should also aim to do a minimum of two sessions of muscle-strengthening activities per week, although these should not be on consecutive days.

Muscle-strengthening activities can include climbing stairs, walking uphill, lifting or carrying shopping, digging the garden, weight training, pilates, yoga or similar resistance exercises that use the major muscle groups. Ideally, the activities and exercises should not only aim to improve or maintain your muscle strength, but also aim to maintain or improve your flexibility and balance. A session at a gym is possibly ideal, but activities at home may be equally as good. For example, stair climbing, stretching and resistance exercises can be done at home without any special clothing or equipment.

A session should be a minimum of 8–10 exercises using the major muscle groups. Ideally, to help build up your muscle strength, use some sort of resistance (such as a weight for arm exercises) and do 8–12 repetitions of each exercise. The level (weight) of each exercise should be so that you can do 8–12 repetitions before the muscle group gets tired. So, for example, for the upper arm muscles, hold a weight in your hand and bend your arm up and down 8–12 times. This should make your arm muscles tire.

Physical activity is thought to help ease stress, boost your energy levels and improve your general wellbeing and self-esteem.

GRAMMAR STRUCTURE

Question Words. Question Words *Who's / Whose*
Ordinal Numerals. Fractions
Active-Passive Transformation

Memorise the following question words used in special question structures:
Who? What? Whose? Whom? When? Where? Why? How? How much? How many?

Notice the difference between Who's /Whose questions. These two questions are often confused
Who's = who is ..? Whose = who does this belong to?

Ordinal numerals may be used to answer «Which» questions:

first, second, third, fourth, fifth, sixth, seventh, eighth, ninth, tenth, eleventh, twelfth, thirteenth, fourteenth, fifteenth, sixteenth, seventeenth, eighteenth, nineteenth, twentieth, twenty-first, twenty-second, etc., thirtieth, fortieth, fiftieth, sixtieth, seventieth, eightieth, ninetieth, hundredth, hundred and first, etc., two hundredth, three hundredth, etc., thousandth, thousand and first, etc., millionth.

Remember: in common fractions, a numerator is denoted by a cardinal numeral, whereas a denominator is denoted by an ordinal one: 1/3 (one third), 1/4 (one fourth or one quarter), 2/5 (two fifths), 1/8 (one eighths), but 1/2 (one half).

Please find below some tips to use ordinal numerals properly:

- *use singular of nouns after fractions: e.g. 1/4 km (one quarter of a kilometre), 1/2 ton (half a ton);*
- *use plural of nouns, if a fraction contains both whole and fractional numbers: e.g. 3.5 tons (three tons and a half);*
- *use a point to separate whole and fractional numbers in decimals: e.g. 1.25 (one point twenty five), 0.789 (nought point seven eight nine);*
- *use ordinal numerals to denote dates: e.g. 31st December or December 31st (the thirty first of December).*

Exercise XIX. Fill in the blanks with the correct question word.

1— studies biology? 2. ... textbook is this? 3. ... is in the laboratory? 4. ... article will be published soon? 5. ... will use acidic solutions in the experiment?

Exercise XX. Introduce help-verbs and corrections whenever necessary. Explain.

1. Who (works) in your laboratory? 2. What methods you (used) in your previous experiment? 3. What (helps) you in your work? 4. When she (will call) you? 5. How much time you (worked) at the problem? 6. Why you (don't return) books to the library? 7. How you (know) that? 8.Where you (will meet) your friends? 9.Why you (didn't come) on time? 10. How many friends he (has) in your city? 11. How much money she (has) on her account? 12. Whose dictionary (lies) on the table? Exercise XXL *Open the brackets and write the correct form of the verb*

1. The concept of equilibrium (to be) one of the most useful and important ideas in the study of chemistry. 2. When water (to boil), the temperature of the liquid (to rise) as long as both liquid and vapour (to be) present. 3. When a mixture (to be) homogeneous, we (to call) it a solution. 4. Gasoline (to dissolve) in water. 5. The terms «concentrated» and «dilute» (to be) qualitative. 6. The solid state of matter (to be characterised) by less potential energy than the liquid or dissolved state. 7. When a solid crystal (to dissolve) in water, the particles (to become) dispersed in the solvent. 8. Supersaturated solutions (to represent) equilibrium, because there is no undissolved solid to dissolve.

Exercise XXII. Restore the questions to the following statements.

1. Evaporation of water helps to regulate your body temperature. 2. The vapour pressure for different liquids varies because the attraction between molecules is various. 3. Water molecules are extremely stable. 4. Most of the physical and chemical processes that are necessary to sustain life occur in water solution. 5. Ion-water molecule attraction is called hydration. 6. A one-molar (1M) solution is one that contains one mole of solute per litre of solution.

Exercise XXIII. In the fragment given below some sentences are false. Make them positive for the text to be true.

SOLID SOLUTIONS

Solid solutions are not rare. Crystals are stable because of the regularity of the positioning of the atoms. A foreign atom interferes with this regularity and, hence, with the crystal stability.

Therefore, as crystal forms, it doesn't exclude foreign atoms. That is why crystallisation doesn't provide a good method for purification. In metals it is not common for solid solutions to form. The atoms of one element enter the crystal of another element if their atoms are not of similar size. Gold and copper form such solid solutions. The gold atoms do not replace copper atoms in the copper crystal and, in the same way, copper atoms do not replace gold atoms in the gold crystal. Such solid solutions are called alloys.

Exercise XXIV. Identify one underlined word that must be changed to make the sentence correct.

1. When solid is add to a liquid, solid begins to dissolve. 2. The components of a solution are the pure substances that is mixed to form a solution. 3. The properties of a solution depends on the relative amounts of the components. 4. Iodine dissolves in ethyl alcohol, but da not dissolve readily in water. 5. Atoms or molecules that carries electric charge are called ions.

Exercise XXV. Make up sentences using the following words.

Solutes / and / both / may be / solvents / and / gases / liquids / solids. 2. A material / when / dissolves / break up / pieces / smaller) the solute / particles / into. 3. The solute / from / the solvent / by filtration / cannot be separated / a solution / in. 4. Common / water / of solvents / the most) is. 5. Organic / compounds / solvents / organic / only / most / can be dissolved / in.

Exercise XXVI. Transform the following into words.

September 1st, 2002, December 20th, 1998, April 26th, 1986, May 10th, 1805, July 4th 1784.
2/3 cm, 4.7 kg, 1/4 ton, 0.5 m, 4.52 km, 1.5 l, 1/5 cm, 1/10 degree.

Exercise XXVIII. Give two possible translations of the following sentences using both passive and active forms of the verbs. Introduce a doer of the action if necessary.

Exercise XXVII. *Translate the following numerical expressions into words.*

1. Поведінка деяких кислот та основ визначається протофільною природою розчинів. 2. Оцтова та сірчана кислоти — розчинники, які використовуються хіміками-органі- ками в багатьох реакціях. 3. Існують характерні реакції, хід яких визначається природою розчинника. 4. Розчини класифікують на підставі характерних груп, які присутні в молекулі. 5. Проводиться велика експериментальна робота по вивченню фізичних та хімічних властивостей безводних розчинів.

SCIENTIFIC COMMUNICATION

Exercise XXIX. Give English equivalents of the words in brackets. Be sure that you understand the text.

Sodium chloride, sugar, ethyl alcohol, and water are four (чистих) substances. Each is characterised by definite (властивостями), such as vapour, pressure, melting point, boiling point, (густина). Sodium chloride (розчиняється) when placed in contact with water. The solid (зникає), becoming part of the liquid. Likewise, sugar (у контакті) with water dissolves. When ethyl alcohol (додається) to water, the two pure substances mix to give a liquid (подібну) in appearance to the (початковий) liquids.

The salt-water (суміш), the sugar-water (суміш) and the alcohol-water (суміш) are called solutions. Solutions (відрізняються) from pure substances in that their properties (змінюються) depending on the relative (кількості) of the constituents. (Поведінка) of solutions during phase changes is dramatically different from that just (описана) for pure substances.

These differences provide, at once, reason for making a (різницю) between pure substances and solutions and, as well, a basis for (вирішення) whether a given material is a pure substance or a solution.

Exercise XXX. Insert words from the list below and use the text as a model of description.

Mixing, homogeneous, dilutes, lower, dissolving, diluted, above, higher, crystallise, depend.

LIQUID SOLUTIONS

Liquid solutions are made by ... two liquids (for example, alcohol and water), by ... a gas in a liquid (for example, carbon dioxide and water), or by ... a solid in a liquid (for example, sugar and water). The result is a ... system containing more than one substance — a solution. In such a liquid, each component is ... by the other component. In salt water, the salt ... the water and, of course, the water dilutes the salt. This solution is only partly made up of water molecules and it is found that the vapour pressure of the solution is correspondingly ... than the vapour pressure of pure water. The boiling point of salt water is ... the boiling point of pure water. The more salt is added, the ... is the boiling point. In a similar way, a lower temperature is required to ... ice from salt water or from an alcohol-water solution than from pure water. In general, the properties of a solution ... on the relative amounts of the components.

Exercise XXXI. Use the following plan to write a description of gaseous solutions. Take Exercise XXVIII as a model.

1. All gas mixtures are homogeneous.
2. All gas mixtures are solutions.
3. Air is an example of a gaseous solution.
4. All gas mixtures are homogeneous.
5. All gas mixtures are solutions.
6. Air is an example of a gaseous solution.

Exercise XXXII. Say which of the statements is correct. Use the following conversational patterns: as is known, to my knowledge, as far as I know, in my opinion, it seems to me that, I believe that, I am absolutely sure that.

I. 1. A true solution is one in which all of the solute is separated into its smallest pieces**.** 2. A true solution is one in which some of the solute is separated into its smallest pieces.

II. 1. When a mixture is homogeneous, we call it a solution. 2. When a mixture is heterogeneous, we call it a solution.

III. 1. Gasoline dissolves in water. 2. Gasoline doesn't dissolve in water.

IV. 1. Iodine is soluble in alcohol. 2. Iodine is insoluble in alcohol.

V. 1. The properties of solutions depend on the relative amounts of solute. 2. The properties of solutions depend on the relative amounts of solvent.

Exercise XXXIII. Use the words and phrases supplied below to make up extensive answers to the questions.

1. What is the effect of temperature on solubility?

(to raise the temperature, to predict the effect of temperature, to absorb the energy, to cause the system to react, to establish equilibrium).

2. What is the effect of pressure on solubility?
(incompressible liquids, compressible gas, atmospheric pressure, direct relationship, given volume).

Exercise XXXIV. Dispute the problems given below. Use the phrases directed specifically at your fellow students: what do you think about... what's your opinion about that... what are your views on...

1. Equilibrium in solutions. 2. Solutions and electricity. 3. General properties of solutions. 5. The nature of solution process.

Exercise XXXV. 1. Be prepared to talk about the classification of solutions.

2.Be prepared to talk about the concentration of solutions.

Exercise XXXVI. Extend the following statements.

1. A solution is a kind of a mixture. 2. Solutions can be made of all three states of matter. 3. We can make a solution stronger. 4. Solid solutions are less common than solid ones.

Exercise XXXVII. Be ready to answer the following questions.

1. Are the solute particles uniformly distributed throughout the solvent? 2. Can the solute particles be seen? 3. Can the solute particles be removed by filtering? 4. What kind of mixture do the solute particles form? 5. Do the solute particles settle out on standing?

Exercise XXXVIII. *What conclusions can be made when you:*

1. Stir sugar into water. Stir sand into water. 2. Make up mixtures of water and potassium permanganate, water and potassium dichromate, water and copper sulphate. 3. Fill two test tubes containing balls of gum camphor with water and with alcohol.

Exercise XXXIX. Describe how to prepare a solution of a specific molarity, given formula of the solute and the atomic masses of the component elements.

Exercise XL. State the difference between molar, normal and percentage solutions. Personify your speech using the following speech connectors:

I suppose, I believe, I guess, to my knowledge, in my opinion, I think, to my mind, my first reason is, my second reason is.

Exercise XLI. Be sure that you follow these instructions.

1. Always wear safety goggles, lab coat and gloves. 2. Never handle hot glass tubing. 3. Never point the open end of a test tube at anyone, including yourself. 4. Carefully read every bottle label twice before using the contents. 5. Never use an open flame near a flammable liquid. 6. Never taste any chemical in the laboratory.

Exercise XLII. Look back at Exercise XXXIX and say what will happen if you don't follow the safety rules.
Model: if we don't wear safety goggles and gloves we'll receive severe burns of eyes and hands.

Exercise XLIII. Translate the text given below and try to do some free writing.

Just write something about water that comes to your mind. Do not stop. Allow your thoughts to come out freely into the open on the paper. Duration: 3 minutes. Another writing task is to limit your topic and to make it more focused

Write how to reduce water consumption in your household and how much water you use per day. Write for 5 minutes. Compare two writings. What in your opinion is the first text lacking?

Supplementary Text

WATER

The importance of water can hardly be overestimated. The temperature of our body is regulated by water evaporation. Mass of certain plants contains 98% of water. A lot of chemical processes and animals occur in water solutions. Climate is greatly affected by water because three- fourths of the earth's surface is covered by water. Pure water is colourless, odourless and tasteless. It is made of molecules, which contain atoms of hydrogen and oxygen. Pure water, unlike polluted water, contains no other materials. To get absolutely pure water the process of distillation is to be used. Water can exist in three states: solid, liquid, or gaseous. Pure water freezes at 0°C and boils at 100°C. Water, unlike other liquids, decreases in density as the temperature is lowered. Molecules of water form hydrogen bonds and this explains why water is liquid at ordinary temperature and has such a high boiling point.

Water can readily react with alkali metals to produce free hydrogen gas and a hydroxide. When water reacts with metallic oxides a base or hydroxide is produced. Acids are formed when water reacts with non-metallic oxides. An oxygen-hydrogen bond is very strong and this explains great stability of water. An electrolytic process is to be used to decompose water molecules.

Exercise XLIV. The author is primarily concerned with:

a) the principles of vaporisation and condensation of water; b) sources of water pollution; c) chemical properties of water; d) physical properties of water.

Exercise XLV. Which of the following statements is not mentioned in the text:

a) water is a cheap solvent; b) the climate is greatly affected by water; c) molecules of water form hydrogen bonds; d) water dissolves a great number of materials.

Exercise XLVI. Does the text supply information for answering the following questions?

a) What are physical properties of water? b) Why is the structure of water molecule polar?
c) Why is water tremendously important to our life? d) Why does the density of water decrease on heating above 40°C?

Exercise XLVII. Read, entitle and discuss the following text.

Water is our most abundant resource, covering about 71% of the earth's surface. This precious film of water helps maintain the earth's climate, dilutes pollutants, and is essential to life. The much smaller amount of fresh water constantly renewed by the hydrological cycle is also vital for agriculture, manufacturing, transportation and other human activities. Despite its importance, water is one of the most poorly managed resources on the earth. We waste it and pollute it.

About 97% of the earth's volume of water is found in the oceans and is too salty for drinking. The remaining 3% is fresh water. But all except 0.003% of this supply is polluted, lies too far under the surface or is locked up in glaciers, polar ice caps, atmosphere, and soil. According to the World Health Organisation, 1.5 billion people do not have a safe supply of drinking water. The major types of water pollutants are disease causing agents (viruses, bacteria), organic wastes, organic and inorganic chemicals, radioactive substances, heat.

Topics for discussion: *harmful effect of human activities, ways to reduce these effects, dumping wastes in the ocean, personal contribution to water conservation.*

Exercise XLVIII. Translate into English.

СУЧАСНИЙ СТАН РІЧКИ ЛИБІДЬ

Перша згадка про Либідь, що дістала назву від імені сестри легендарних засновників Києва, з'являється ще у стародавніх літописах.

Починається річка з джерел серед Києва й впадає у Дніпро з правого берега поруч селища Корчуватого. Довжина — 14 км, площа басейну — 68 км^2. Либідь охоплює центральну та південно-західну частини міста. На жаль, сьогодні річка має специфічний запах побутовах стоків, середнє значення мутності — 1/5 г/л.

Либідь ніколи не замерзає взимку, тому що температура води тут вища за 0°С. Це обумовлено стоками побутових та промислових господарств. У воді міститься значна кількість іонів важких металів (Cr, Pb, Cu, Ni), що перевищує гранично допустиму норму (ГДН).

Екологічний стан знаменитої річки потребує негайного проведення природоохоронних заходів.

Exercise XLIX. Restore the dialogue.

Exercise L. Back to «Our Planet». Another geology quiz for you.

1. State the name of all molten rock material.
2. State the name of the age concept referring to the occurrence of a geologic event measured in the number of years ago.
3. Name the family of rocks which form directly from the cooling of molten rock.
4. State, which portion of the core (inner or outer) is comprised of liquid.
5. Name the family of rock which is the most likely to contain an abundant record of fossils.
6. State the name of the rigid outer shell of the earth consisting of the crust and upper solid material.

Choose the correct answer: *igneous, magma, outer, lithosphere, sedimentary, absolute age.*

Unit Six

Exercise I. Pronounce the following words

ecology
science
nature
condition
affect
organism
earth
virtually
ecosystem
environment
major
surface
atmospheric

Exercise II. Pronounce the following word combinations:

coin the term
external conditions
study interaction
different ecosystems
various chemicals
below the ocean's surface
above sea level
abiotic components
earth surface

Text A

ECOLOGY AND ECOSYSTEMS

Keywords: biosystem, biosphere, ecology, environment, organism, species, wastes.

Ecology is the science that tries to answer such questions about how nature works. In 1865 German biologist Ernst Haeckel coined the term *ecology* from two Greek words: *oikos,* meaning «house» or «place to live», and logos, meaning «study of».

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

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

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

Ecosystems consist of various nonliving and living components. The nonliving or abiotic components include various physical and chemical factors.

Among physical factors affecting ecosystems are sunlight and shade, temperature, precipitation, wind, soil, fire, etc. Major chemical factors include: level of water and air in soil, level of nutrients, level of toxic substances, sanity of water and some others.

The major types of organisms that make up the living or biotic components are usually classified as producers, consumers and decomposers. This classification is based on organisms' general nutritional habits. Green plants are producers as they make the organic nutrients through photosynthesis. Only producers can make their own food. They provide food directly or indirectly for animals and decomposers. We get nutrients either by eating plants or by eating animals that feed on plants.

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

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

VOCABULARY AND COMPREHENSION

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

1. What is ecology?
2. How was the term ecology coined?
3. What are the components of biosphere?
7. What is the ecosystem and what are its major living and nonliving components?
8. What happens to matter in an ecosystem?
9. How do organisms interact in an ecosystem?
10. Why are there fewer lions than mice in an African ecosystem supporting both types of animals?

Exercise IV. Study definitions of the following words.

Ecology — study of the interaction of living organisms with each other and with their environment; study of the structure and functions of nature.
Ecosystem — community of organisms interacting with one another and with chemical and physical
factors making up their environment.
Nutrient — element or compound needed for the survival, growth and reproduction of a plant or an animal.
Organism — any form of life.
Photosynthesis — complex process that takes place in cells of green plants. Radiant energy from the sun is used to combine carbon dioxide ($C0_2$) and water (H_20) to produce oxygen (0_2) and simple nutrient, such as glucose ($C_6H_{12}0_6$).

Exercise V. Give terms matching the following definitions. Choose from community, environment, ecosystem and chemical.

1. Population of different plants and animals living in an area at a particular time is called ...
2. All external conditions that affect an organism during its life are called ...
3. Collection of living and dead organisms interacting with one another and their environment throughout the world is called ...
4. One of the millions of different elements and compounds found in the universe is referred to as ...

Exercise VI. Choose the words which are synonymous to the initial ones.

Study	**Major**	**Nonliving**	**Nutrient**
Work	**Important**	**Inorganic**	**Meal**
Experiment	**Principal**	**Abiotic**	**Food**
Learning	**Interesting**	**Biotic**	**Component**
Research	**Large**	**Detritus**	**Dish**

Exercise VII. Give opposites of the following phrases.

a) External conditions, living organism, different ecosystems, thin film, above sea level, toxic substances, soluble nutrients;

b) To sustain life, to decompose matter, to affect an organism, to carry on an experiment.

Exercise VIII. Paraphrase the following sentences, substitute words and expressions from the text for the underlined parts of the sentences.

1. Ecology is the science that attempts to explain how nature works. 2. In 1869 German biologist Ernst Haeckel derived the term ecology from two Greek words. 3. Ecology studies live organisms in environment and all the surrounding factors that influence them. 4. There are several important components that help to support life on Earth. 5. Principal chemical causes include: level of air pollution, soil contamination, water sanity, toxicity of matter, etc.

Exercise IX. Translate the following sentences using words and word combinations from the text.

1. Екологія — це наука про природу. 2. Німецький біолог Ернст Хекель запровадив термін «екологія» у 1869 році. 3. Цей термін був утворений на основі двох грецьких слів: oikos («house») та logos («study of»). 4. Екологія вивчає взаємодію між організмом та його оточенням. 5. Головне завдання екології— зрозуміти, як функціонують різні екосистеми. 6. Усі живі організми, що складають біосферу, взаємодіють між собою. 7. Екосистеми містять як живі, так і неживі компоненти. 8. Ми знаємо, що фотосинтез — це складний процес, що проходить у клітинах зелених рослин. 9. У процесі фотосинтезу із двоокису вуглецю та води утворюється кисень. 10. Усі компоненти будь-якої екосистеми взаємодіють між собою напрочуд раціонально та ефективно.

Exercise X. Read the following text and guess the right answers.

ENVIRONMENTAL LESSONS

The organisms that make up the population of various biocommunities and ecosystems have some ability to withstand or recover from externally imposed changes or stresses. In other words, organisms have some degree of stability. Nature is remarkably resilient and can restore itself to an original condition after being exposed to an outside disturbance that is not too drastic. Plants recolonise areas devastated by volcanoes, retreating glaciers, mining, bombing, and fanning, although such natural restoration usually takes a long time on a human time scale.

Ecosystems are affected by a number of natural and human-caused changes. Some of these changes are gradual, say changes in climate, immigration and emigration of species, adaptation and evolution of species as a response to environmental stress, ecological succession. Others like drought, flood, fire, volcanic eruption, earthquake, hurricane, disease are sudden or catastrophic. Additionally, the changes can result from human activities such as industrialisation, warfare, transportation, agriculture and many others. The species well adapted to their environment have four major ways to deal with an environmental stress: decrease in birth rate or increase in death rate; migrate to another area with less stressful environment; adapt to changed conditions through natural selection; become extinct.

Which of the following is not true?

a) nature has high degree of stability and resilience;
b) plants can recolonise various devastated areas very quickly;
c) the organisms have some ability to withstand externally imposed changes and stresses;
d) ecosystems are affected only by human-caused changes;
e) catastrophic natural changes include changes in climate, and adaptation of species due to environmental stress.

The word gradual means most nearly:

a) slow;
b) step by step;
c) graduated;

d) evolutional.

How would you describe human-caused changes in ecosystems?

a) catastrophic;
b) stressful;
c) hazardous;
d) killing;
e) natural;
f) dynamic.

Which of the following is not a natural change of ecosystems?

a) fire;
b) drought;
c) earthquake;
d) disease;
e) soil erosion;
f) hurricane.

What words would describe your feelings after reading the text Environmental lessons?

a) peaceful;
b) uncomfortable;
c) scary;
d) excited;
e) happy;
f) surprised;
g) confused;
h) pleasant.

Exercise XL Open the brackets and choose the correct word or word combination to make the sentences true.

1. Bionics is a science that treats utilisation of *(physical/biological)* processes and methods in solving engineering problems.
2. Physiology is concerned with the study of the functions, i.e. the *{living/nonliving)* processes of organisms, of their organs, tissues and cells.
3. Great changes occurred in natural sciences in the 19th century, when physiology, separated off from (*anatomy/botany*), became a completely independent science and made immense progress.
4. There are 500,000 *{different/identical)* species of plants and 1,500,000 different species of animals, i.e. (*three/five)* times as many.

Exercise XII. Decide which word best fits the meaning of the sentence.

1. Ecology is the science that _____to answer questions about how nature works.
   (wants or attempts)
2. The living organisms that make up the biosphere interact with one another, with energy of the sun, and with various _____in the atmosphere.
   (chemicals or compounds)
3. The source of the energy that _____ life on earth is the sun.
   (helps or sustains)
4. The sun is a gigantic fireball composed of hydrogen (72%) and _____ (28%) gases.
   (helium or nitrogen)

5. *Any* element or compound an organism needs to live, grow, and reproduce is called a _____ .

(nutrient or water)

6. Most of the earth's chemicals do not occur naturally in forms _____to the organisms that make up the biosphere.

(useful or hazardous)

7. Recycling of nutrients takes place in biogeochemical cycles ***(bio*** meaning _____ , ***geo*** for «earth», and ***chemical*** for changing of matter from one form to another).

(«human» or «life»)

WORD-BUILDING

Exercise XIII. Give verbs of the following nouns. Check them in the dictionary.

1. An attempt, coin, study, question, answer, term, change, play.
2. A collection, interaction, evolution, examination, observation, reaction, pollution, radiation, production, population, combination.

Exercise XIV. Write down all the terms coined using «eco» (Greek oikos, meaning «house» or «place to live»).

Exercise XV. Use suffix «-ly» to form adverbs of the following adjectives.

External, internal, usual, frequent, chemical, large, main, principal, dear, interesting, fundamental, eventual, fortunate, organic, natural, biological, ecological, environmental.

Exercise XVI. Say of what components the following terms are made.

Ecosystem, biosphere, biology, geology, hydrosphere, lithosphere, ecosphere, photosynthesis, abiotic, biogeochemical, antibiotic.

Exercise XVII. Transbte the following words. Mind the contrastive prefix «anti-». Coin some terms using «anti». Check your «coinage» in the dictionary.

Antibiotic, antibody, anticentre, anticlinal, anticyclone, antidote, antifebrile, antigen, antiflo- gistic, antipathy, antipole, antipyrine, antiseptic, antitoxic, antitoxin, antithesis.

Exercise XVIII. Translate the terms with the prefix «a-». Compare its meaning with the meaning of the prefix «anti-».

Aberrance, aberrant, aberration, abiotic, asymmetry, asymmetric, acyclic, aclynic, aclinal, achromatism, achromatic, afocal, amorphism, amorphic, aharmony, aharmonic.

Exercise XIX. Use contrastive prefix «counter-» to form derivatives of the following words. Can «anti-» be used here to render the same idea? Explain.

Action, balance, buff, clockwise, flow, force, ion, measure, pressure, radiation, sun, trade, weight.

Text B

MENTAL HEALTH

Stress may be considered as any physical, chemical, or emotional factor that causes (викликати) bodily or mental unrest (розлад) and that may be a factor in disease causation (етиологія). Physical and chemical factors that can cause stress include trauma, infections, toxins, illnesses, and injuries of any sort. Emotional causes of stress and tension (напруга) are numerous and varied. While many people associate the term «stress» with psychological stress, scientists and physicians use this term to denote (означати) any force that impairs (послаблювати) the stability and balance of bodily functions.

If stress disrupts (підривати) body balance and function, then is all stress bad? Not necessarily. A mild degree of stress and tension can sometimes be beneficial. For example, feeling mildly stressed when carrying out (виконувати) a project or assignment often compels (заставляти) us to do a good job, focus better, and work energetically. Likewise, exercising can produce a temporary stress on some body functions, but its health benefits are indisputable. It is only when stress is overwhelming, or poorly managed, that its negative effects appear.

An important goal for those under stress is the management of life stresses. Elimination of stress is unrealistic, since stress is a part of normal life. It's impossible to completely eliminate stress, and it would not be advisable to do so. Instead, we can learn to manage stress so that we have control over our stress and its effects on our physical and mental health.

Stress is related to both external and internal factors. External factors include your physical environment, your job, relationships with others, your home, and all the situations, challenges, difficulties, and expectations you're confronted with on a daily basis. Internal factors determine your body's ability to respond (реагувати) to, and deal (справлятися) with, the external stress-inducing factors. Internal factors which influence your ability to handle (керувати) stress include your nutritional status, overall (спільний) health and fitness levels, emotional well-being, and the amount of sleep and rest you get.

Managing stress, therefore, can involve making changes in the external factors which confront you or with internal factors which strengthen your ability to deal with what comes your way.

GRAMMAR STRUCTURE

Making Subjects, Verbs and Pronouns Agree

Exercise XX. Edit the following sentences for problems with subject-verb agreement.

1. High concentrations of carbon monoxide results in headaches, dizziness, unconsciousness, and even death.
2. Small pieces of fermented bread was placed around the edge on the platter.
3. Nearly everyone of the expedition were amazed by the sight.
4. Someone in the audience has volunteered to participate in the experiment.
5. Most of my friends study biology.
6. There is about 10 people in our group.
7. There is plenty of opportunities of work on the campus.
8. One of the best courses I've taken in college is psychology.
9. A number of articles describes the distribution of the tropical rain forests which form a green band around the earth at the equator.
10. The tropical forests is cut down day after day.
11. Few people know the number of medicines that is derived from plants.
12. Neither of these plants are valuable in folk medicine.

Exercise XXI. Choose the correct form of the verb. Follow the rules of subject- predicate agreement.

1. Prof. Johnson with 10 researchers from our laboratory (plan/plans) a new expedition.
2. The levels of soil contamination on this site (is/are) too high.
3. No question (is/are) harder to answer than this one.
4. Nobody (know/knows) the problem better than Nick.
5. None of the plants (find/finds) application in folk medicine.
6. Neither plants nor animals (is/are) affected in this area.
7. Both toxic chemicals and acid rain (contaminate/contaminates) soils in the region.
8. There (is/are) plenty of plant species in tropical forests.
9. The majority of students (is/are) interested in environmental issues.

SCIENTIFIC COMMUNICATION

Exercise XXII. Read, translate and discuss the following text.

CUTTING EVOLUTION DOWN TO OUR SIZE

We have a good idea of what made evolution tick in the past. Now we need to consider how to keep it ticking at a time when thanks to disruption to the environment, we are not only eliminating many species, but also severely reducing the natural capacity to general replacements.

All living forms are in flux, although the speed of change can vary greatly according to species; a few thousand generations of evolution can leave a shark as a shark or turn a mouse into something the size of elephants. Evolution can take many millions of years; or react quickly to changing conditions: an asteroid hits earth, tectonic plates push up mountains, volcanoes cover the sky with dust, variations of climate create or drown deserts. But over 3.8 billion years of change life carried on, and even produced such exotic creatures as us.

Our impact on the conditions of life on earth is already evident. A periodical visitor from outer space would find more changes in the past 200 years than in preceding 2,000 and more change in the past 20 years than in preceding 200.

First, there has been an amazing increase in human numbers, from about 1 billion 200 years ago to more than 6 billion today. Next is deterioration of the land surface, with increasing exploitation of resources, and ever-mounting quantities of waste, some of it toxic. Then there is pollution of fresh and salt water. We are at present using at least half of all available water.

We are changing the chemistry of the atmosphere, with acidification of certain areas, depletion of the ozone layer, and large increases in carbon dioxide among other greenhouse gases affecting the world's climate.

Exercise XXIII. Make a list of negative human and nonhuman factors affecting our planet.

Exercise XXIV. What do you know about plant species extinct in Ukraine? Make a list of them.

Exercise XXV. Write a thesis statement to render an idea of the geological process impact on evolution. Support your thesis with reasons or points.

Exercise XXVI. Write a summary of the text «Cutting Evolution Down to Our Size».

Exercise XXVIL Use the thesis of the above-mentioned text to organise your paper on futurological prognosis of the evolution on our planet.

Exercise XXVIII. Get familiarized with some clever phrases on the environmental issues. Try to follow the example to express your feelings about nature pollution.

What's the use of the house if you don't have a decent planet to put it on? (Henry D. Thoreau). A continent ages quickly once we come (Ernst Hemingway). A weed is a plant whose virtues have not yet been discovered (Ralph Waldo Emerson). Solid wastes are only raw materials we're too stupid to use (Arthur C. Clarke). There is something fundamentally wrong in treating the earth as if it were a business in liquidation (Herman E. Daly). We sang the songs that carried in their melodies all the sounds of nature — the running waters, the sighing of winds, and the calls of the animals. Teach these to your children that they may come to love nature as we love it (Grand Council Fire of American Indians).

Exercise XXIX. Works by Gary Larson are very popular among American students. Get familiarised with his ironical look at the evolution.

Supplementary Text

WATER LIFE

Water is the home to a wide range of microflora and microfauna. All animal and vegetable microorganisms which move in water, including those that attach themselves to plants and rocks, are called plankton (from the Greek word *planktos* meaning «wandering» or «drifting»). Planktonic organisms are classified as plants (phytoplankton) or animal (zooplankton). Freshwater plankton is termed limnoplankton, marine forms are known as haloplankton. Plankton life is important for equatic ecosystem, and it is the main source of nutrients for fish and larvae.

The interaction of producers, consumers and decomposers creates biological equilibrium in water. Plants and phytoplankton are producers. The consumers include animals and zooplankton. Enormous quantities of bacteria promote decomposition of dead animal and vegetable matter. Over time, all organically polluted water becomes self-cleaning, on condition that excess nutriment is not constantly introduced.

Unfortunately, water gets increasingly polluted by agriculture and industry. The amount of pollutants and toxic substances is so great that even novel water-purification installations are of little help.

Only when researchers go into the fascinating world of the water microcosm, they become aware of the most sensitive environmental indicators in water. Scientists use stereomicroscopes to capture, study and then release various species unharmed. In this way they receive information on the environmental condition of water ecosystems. The stereomicroscope seems to be the ideal device for revealing the secrets of water microcosm, observing and documenting microscopic life forms as gently as possible.

Match the topic sentences with the relevant paragraphs of the text. Give your reasons to support the choice.

a) Water gets increasingly polluted.
b) Stereomicroscope is microcosm-friendly instrument to study water pollution.
c) The balance of microorganisms is needed for water self-cleaning.
d) Plankton is of vital importance for aquatic ecosystems.

Mini-Test

1. Write 10 keywords of the Unit.
2. Write English equivalents of the following word combinations.

Створити термін, вивчати живі істоти, природне середовище, негативно впливати на організм, досліджувати різні екосистеми, взаємодіяти один з одним.

3. Match the words on the left and the definitions on the right.

Ecology.	Any form of life.
Ecosystem.	Study of the interactions of living organisms with each other and their environment.
Photosynthesis.	Community of organisms interacting with one another and with the environment.

4. Give synonyms to the following words.

Major, nutrient, study, goal, environment, nonliving, different, grasslands, chemicals, sanity.

5. Give antonyms to the following phrases: to answer questions, living things, different ecosystem, to sustain life, above sea level.

6. Make predicates agree with their subjects.

1. There (to be) a number of modem instruments in this laboratory.
2. Neither of these students (to be) present at the lecture.
3. The majority of the students (to want) to study foreign languages.
4. Neither the professor nor his assistants (to know) the solution of the problem. Make tag questions from the following sentences.

1. Ecology is the science that studies how nature works.
2. Scientists carry on their studies examining different ecosystems.
3. The Earth has several major parts that play a role in sustaining life.
4. Ecosystems consist of various living and nonliving components.

7. Write three forms of ten irregular verbs. Then check your accomplishment using the list of the irregular verbs.

Unit Seven

Exercise I. Pronounce the following words:

knowledge
observation
analysis
constituent
tissue
approximately
condition
characteristic
adaptation
variability
individual
(to) approximate

Exercise II. Pronounce the following word combinations:

biological data
various conditions
same species
errors of observation
due to the variability
exact science
overcome the handicap
prove a basis
furnish evidence

Text A

MENTAL HEALTH

Stress may be considered as any physical, chemical, or emotional factor that causes (викликати) bodily or mental unrest (розлад) and that may be a factor in disease causation (етиологія). Physical and chemical factors that can cause stress include trauma, infections, toxins, illnesses, and injuries of any sort. Emotional causes of stress and tension (напруга) are numerous and varied. While many people associate the term «stress» with psychological stress, scientists and physicians use this term to denote (означати) any force that impairs (послаблювати) the stability and balance of bodily functions.

If stress disrupts (підривати) body balance and function, then is all stress bad? Not necessarily. A mild degree of stress and tension can sometimes be beneficial. For example, feeling mildly stressed when carrying out (виконувати) a project or assignment often compels (заставляти) us to do a good job, focus better, and work energetically.

Likewise, exercising can produce a temporary stress on some body functions, but its health benefits are indisputable. It is only when stress is overwhelming, or poorly managed, that its negative effects appear.

An important goal for those under stress is the management of life stresses. Elimination of stress is unrealistic, since stress is a part of normal life. It's impossible to completely eliminate stress, and it would not be advisable to do so. Instead, we can learn to manage stress so that we have control over our stress and its effects on our physical and mental health.

Stress is related to both external and internal factors. External factors include your physical environment, your job, relationships with others, your home, and all the situations, challenges, difficulties, and expectations you're confronted with on a daily basis. Internal factors determine your body's ability to respond (реагувати) to, and deal (справлятися) with, the external stress-inducing factors. Internal factors which influence your ability to handle (керувати) stress include your nutritional status, overall (спільний) health and fitness levels, emotional well-being, and the amount of sleep and rest you get.

Managing stress, therefore, can involve making changes in the external factors which confront you or with internal factors which strengthen your ability to deal with what comes your way.

Text B

BIOLOGICAL VARIATION

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

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

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

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

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

VOCABULARY AND COMPREHENSION

Exercise III. Answer the following questions.

1. What does biochemistry derive most of its knowledge from? 2. What must the knowledge that is gained by observation on each differentiated tissue be interrelated with? 3. Can organism be separated from its environment? 4. What is the environment of the organism formed by? 5. Under what conditions must all biological data be obtained? 6. What are the errors of observation due to? 7. What must experimenters do in order to overcome the handicap of biological variation?

Exercise IV. In what line of the text do you read:

1) that the knowledge that is gained by observation on each differentiated tissue must ultimately be interrelated with the reactions of the organism as a whole; 2) that the organism can never be separated from its environment; 3) that the environment of the organism is very complex; 4) that all the biological data must necessarily be obtained under various conditions of the environment; 5) that normal values are obtained only when an organism and its environment are in approximate adaptation and harmony; 6) that the errors of observation that are made upon biological material are often very great.

Exercise V. Note carefully definitions of the following words.

Constituent — forming or helping to make a whole.
Tissue — any of the substances forming part of the animal or plant.
Environment — surroundings, conditions of life and growth.
Variability — condition of being in disagreement.
Handicap — something that hinders or lessens one's chance of success.

Exercise VI. Write down the definitions of:

error, adaptation, species, evidence.

Exercise VII. From the following choose the word which is opposite in meaning to the italicized one.

Various — different, similar, exact, known.
Separate — belong, occupy, put apart, connect.
Complex — simple, complicated, difficult, correct.
Approximate — nearly resembling, complete, intermediate, exact.
Correct—incorrect, right, accurate, corresponding.

*Exercise VII**.** Choose the one word that best keeps the meaning of the original sentence.*

1. The organism can never be separated from its *environment.*
   a) surroundings
   b) condition
   c) variation
   d) observation
2. The *errors* of observation are often very great.
   a) faults
   b) mistakes
   c) results
   d) reasons
3. All the experiments must be correctly *designed*
   a) referred to
   b) spoken about
   c) written down
   d) planned out
4. The results of the experiment will *yield* the information of the primary factors.
   a) start
   b) give
   c) show
   d) obtain

Exercise X. Which of the following statements is false?

1. Today most serious questions about cell growth and division are studied by using micro-organisms especially the bacteria.
2. Today most serious questions about cell growth and division are studied by using micro-organisms especially the fungi.
3. Some bacterial viruses do not always multiply upon entering a host cell.
4. Some bacterial viruses always multiply upon entering a host cell.
5. Some primitive animals, primarily bacteria are doomed to environments where is little or no oxygen at all.
6. Some primitive animals, primarily bacteria are doomed to environments where is much oxygen.
7. Most serious questions about cell growth and division are studied by using microorganisms.
8. Most serious questions about cell growth and division are studied by using plants.
9. Used as fuels are fats, carbohydrates and, to certain extent, proteins which «bum» in organism to form carbon dioxide and water.
10. Used as fuels are fats, carbohydrates and, to certain extent, proteins which «bum» in organism to form oxygen and water.

WORD-BUILDING

Exercise XI. Underline the suffixes in the following words and state what parts of speech they form.

Electrical, activity, information, transmitter, directly, physiological, electromagnetic, chemically, organism.

Exercise XII. Give as many derivatives as possible of the following words and translate them into Ukrainian. Draw a pictorial «word-flower» of «characteristic» derivatives.

Advance, special, system, biology, difference, organism, presence, characteristic, necessity, variability, observation.

Exercise XIII. Give the nouns from which the following adjectives are derived

What noun-forming suffixes do you know? Draw a pictorial «word-flower» of abjective- forming suffixes you know.

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

Exercise XIV. Form nouns from the following verbs. Translate them into Ukrainian.

To introduce, to detect, to create, to determine, to locate, to radiate, to vary, to consider, to inform, to transform, to invert, to continue, to vapourise, to begin, to attract.

Exercise XV. Pay attention to the following way of word-building. Read and translate the pairs of words. Mind the stresses.

To pre'sent — a 'present
To sub'ject — a 'subject
To object — an 'object
Todec'rease —a'decrease
To inc'rease — an 'increase
To re'cord — a 'record
To pro'gress — a 'progress
To con'duct — a 'conduct

GRAMMAR STRUCTURE

Review of Passive Constructions
Subject-Verb Agreement with Some Foreign Words

Exercise XVI. Translate the following sentences paying attention to the passive constructions.

The importance of water to living things is so evident, that it need not be insisted on here.

Darwin and A. R. Wallace, working independently of each other had simultaneously developed theories that were identical. Both had been influenced by H. R. Maltus' work on population, both were familiar with Dyell's views on geology, each had observed widely varying species.

The advantages of using differentiated hosts with single resistance genes will be referred to.

This method can be relied upon in our experiment.

Some kind of cells can be rather clearly seen in their living state, when they are looked at under the microscope.

In this chapter the initial questions set forth above will be dealt with.

The mammalian body is composed of at least a hundred different types of cells.

Exercise XVII. Find the sentences in which the form with -ed is a part of the passive construction.

Many experiments made after helped us to come to this conclusion.

The substance obtained showed unusual properties.

The amoebae are influenced by variations in the water content and temperature of the soil.

The species collected varied in their characters.

The biological function of nuclear matrix is not limited to the maintenance of the structural integrity of the nucleus.

If nuclear matrix preparations are isolated without RNAase treatment, then the rapidly labeled nuclear RNA remains associated with the matrix and forms the «ribonucleoprotein network».

These results are in a good agreement with the data obtained with nuclear matrix of the lungs when a similar dynamics of labeled amino acids incorporation into proteins was observed.

Many common features will be noticed by comparing the proliferation of cells belonging to RPE.

Much effort will be devoted to learning how to grow the cells of multicellular organisms in an isolated system.

Exercise XVIII. Change the following sentences using passive constructions.

We make many experiments in our laboratory.

I shall use this material in my report.

Our chemical enterprises produce many new artificial materials.

The high standard of work at that plant impressed the visitors.

Darwin based his theory of evolution on reliable facts.

In 1859 Darwin published «The Origin of Species by Natural Selection».

We shall thoroughly analyse this process.

Man and animal require food.

Nearly all animals, including humans, emit into seawater direct-current fields.

We shall register this action potential by means of a microelectrode introduced into the cell protoplasm.

The organism will receive adequate amounts of all the necessary elements through the food and water consumed.

Scientists make much progress in the study of the functions and regulation of the internal organs.

They will obtain many new facts and theoretical postulates in the field of comparative physiology.

Exercise XIX. Make the following sentences interrogative.

The developed mammary glands of certain higher animals are provided with a special muscle apparatus made up of myo-epithelial cells.

Each specific protein will be controlled by a gene unique for that protein.

A molecule of sugar or of water is divided into single atoms or groups, but then it is no longer sugar or water.

Inorganic substances will mainly be focused on.

Cancers are treated by using drugs, which inhibit the division of cells.

The most rapidly dividing cancer cells will be affected by these drugs before the more slowly growing normal cells.

The conference is devoted to important present-day problems in plant physiology.

Exercise XX. *Notice some words with unusual singular and plural forms that English borrowed from other languages (Greek and Latin).*

alumna	alumnae
alga	algae
analysis	analyses
appendix	appendices
basis	bases
crisis	crises
criterion	criteria
datum	data
index	indices
medium	media
nucleus	nuclei
phenomenon	phenomena
radius	radii
spectrum	spectra
vita	vitae

Make subjects and verbs agree in the following sentences.

Alumni of the university (take/takes) active part in students' life. Phenomenon of sublimation (is/are) studied by chemistry. Data obtained in this laboratory (is/are) reliable. Analysis of these compounds (show/shows) their biological activity. Infrared spectra (provide/ provides) much information on the structure of matter. The algae in the lake (are/is) too hazardous. Acidic medium (is/are) lethal for some bacteria. Appendices (is/are) at the end of the book.

SCIENTIFIC COMMUNICATION

Exercise XXI. Entitle the text given below. Then match topic sentences with the paragraphs of the text. Finally, choose the relevant thesis sentence and support it with some reasons. Please, be reminded that a thesis sentence is the main idea of the text that an author wants to get across to his reader. In a paragraph it's called a topic sentence.

Sixty-five million years ago, between the Cretaceous and the Tertiary periods, a rock the size of Manhattan screeched across the sky, tearing through the earth's atmosphere at somewhere between 25,000 and 160,000 miles per hour. It crashed into the shallow sea where Mexico's Yucatan peninsula now lies. The impact was so great that the asteroid was instantly vaporized, exploding with the force 10,000 times greater than that of the world's entire arsenal of nuclear weaponry.

In as little as a year, the fierce, dust-choked aftermath had wiped dinosaurs off the face of the earth, together with as many as 70 percent of all other species.

In 1980 a group of scientists from the University of California, Berkeley, among them a Nobel prize winner physicist L. W. Alvarez, his son, a geologist and two nuclear chemists published the hypothesis of the great impact. They found something that no paleontologist had ever noticed: layers of rock deposited 65 million years ago contain high concentrations of iridium. Iridium is rare on the earth surface but abundant in meteorites.

Paleontologists at first dismissed the asteroid hypothesis, but in the next two decades some dramatic discoveries confirmed that an impact had taken place. At more than a hundred sites worldwide, a thin layer of clay formed between the Cretaceous and the Tertiary periods was found to contain high concentrations of iridium. The same layer also contained shocked quartz, tektites and minute glassy spheres — geologic features that could be formed only by a violent impact. In 1991 an immense crater was found along the Yucatan coastline. The crater is close in size to and exactly the age of the one predicted by the four investigators.

Yet, some investigators note that the number of dinosaurs began to decline millions of years before the impact, whereas some marine and plant species survived long after.

Impact theorists wave such questions away, attributing the survival of amphibians, crocodiles and turtles to «sheer luck». They ignore many reasonable questions that skeptics raise; yet these questions remain.

Topic Sentences

1. Berkeley team of investigators put forward the hypothesis of great impact.
2. Survival of some species was a sheer luck?
3. 65 million years ago the asteroid hit the Earth and wiped 70% of living species.
4. Extinction of dinosaurs began long before the great impact.
5. Numerous discoveries confirm the hypothesis.

Thesis Sentences

1. How the world ended.
2. Dinosaurs were wiped off the face of the earth by the asteroid impact.
3. The hypothesis of great impact raised more questions than answers.
4. Paleontologists dismiss the asteroid hypothesis.
5. Scientific team from the University of California put forward the brilliant and convincing hypothesis of the great impact.

Now choose the best relevant thesis sentence and support it with three reasons or examples to show a reader that it is true.

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

Physiology (зв'язана) with the study of the functions, i.e. the living processes of organisms, and of their organs, (тканин), and cells and the structural elements of cells. (Спроби) to understand the vital activity of the human and animal organism have been made since the dawn of civilization. Ideas of anatomy and physiology are to be found in the works of philosophers and physicians of (давньої) China, India, Greece and Rome.

Great (зміни) occurred in the natural sciences in the 19th century, when physiology, separated off from anatomy and histology, became a completely (незалежною) science and made immense progress. A new (напрямки) in world physiology are founded by the famous physiologists and clinicians Sechenov, Pavlov, Botkin, Bekhterev and others.

In the 20th century new (галузі) of physiology have developed, among them microbiology, chemical physiology, endocrinology and others.

Much progress has been made in the study of functions and regulation of the (внутрішніх) organs, the cardiac principles have been analysed (детально), the study was made of vascular reactions, capillary circulation, mechanism of (дихання).

Many new facts and theoretical (постулатів) obtained in the field of (порівняльної) physiology and physiology of (старіння) have made it possible (створити) a new branch of science, evolutionary physiology**.**

Exercise XXIII. Use the words and phrases supplied below to make up answers to the questions.

1. Since when has man become interested in comings and goings of the birds? (hundreds of thousands years ago). 2. What do we call birds that stay near their homes throughout the year? (birds-residents). 3. When do birds start migrating? (breeding season, to be over). 4. Could the change of climate on the planet be the reason for birds' migratory flights? (to be really powerful and efficient fliers). 5. When did serious scientific study of bird migration begin? (a hundred year ago). 6. When and where were the first proper maps of migratory movements made? (1855, Russia). 7. Where was the first migration station set up? (1901, Germany). 8. What do scientists begin to do to get more information about birds? (to fasten tiny transistors to the birds' backs). 9. How do birds know when to start their migration flights and what direction to go? (the changing day-length). 10. How do birds find their way on these enormously long journeys? (parents fly off first). 11. What do you know about birds migration in your area? 12. What do we call a scientist that studies birds? 13. Have you ever participated in the «study-bird-migration» project?

Exercise XXIV. State and explain the following trends.

1. From earliest times plants have played an important part in everyday life of mankind.
2. Plants fmd wide application in folk medicine.

Exercise XXV. Insert the missing words given below.

Concerned, due to, though, scientists, living, blood, research, strong, illness.

1. Our ... have long been interested in magneto-biology, a science ... with the influence of magnetic fields on ... organisms. 2. The influence in the number of studies on this subject is ... the application of strong magnetic fields in different industries and the development of space ... 3. **...** people do not notice any effect of permanent magnetic fields, it was found that those working in ... magnetic fields develop changes in the nervous and cardio-vascular system and also certain biochemical morphological changes in their ... 4. These changes don't cause .., provided the person doesn't stay too long in the magnetic field area.

Exercise XXVI. Complete the following sentences.

1. The ability of the eyes to function in a minimum amount of light depends on ... 2. The most important function of vitamin D is ... 3. As an anti-oxidant vitamin E prevents the formation of ... 4. Vitamin Bi_2 is found in animal... 5. The first to report a scientific relationship between diet and disease was ... 6. Although some vitamins are synthesized in the body, their usual source is...

Exercise XXVII. Dispute the problems outlined below.

1. Both animals and plant cells contain organic substances and mineral salts. 2. Water has conditioned the Earth's climate. 3. Oxygen is essential for life and it has to be obtained from somewhere to supply every cell of the organism with it. 4. Ever since man came into being he has been intrigued by the language of animals.

Exercise XXVIII. Correct wrong statements using the following phrase openings: it seems to be wrong, I am afraid you are mistaken, I disagree, you seem to be wrong.

Man contains about 30% of water. Water content of all living organisms depends only on the species. Hydrogen, carbon, oxygen, nitrogen and sulfur make up 99% of the mass of all living things.

Carbohydrates are the most abundant molecules not only in amount but in the variety of molecular species present. Hydrogen belongs to halogen family and is contained in all living creatures.

Exercise XXIX. Write five sentences about the effect of radiation on a living organism.

Exercise XXX. Entitle the following passage, write down the keywords and thesis sentence.

Some plants naturally absorb heavy metals from the soil, and with soil conditioning or genetic engineering they can soak up even more. So for a growing number of phytominers, there is gold in them — thars hills.

Last fall, geochemists from New Zealand reported concentrating gold in plant tissues for the first time. At amounts of between one and 2,000 times the usual background levels, that is not a mother lode: the quantity of gold absorbed is still measured in parts per million. But the process can be made to pay, the investigators calculate, if the price of gold is high enough and the energy from burning the plants in the extraction process is also sold. The New Zealand scientists note that in Australia many 19th century mine tailings are the leftovers of inefficient extraction methods, and so could be attractive targets for phytomining.

Not everyone is convinced, however, that the method has the Midas touch. They say that real value of plants as miners come from their ability to suck toxic heavy metals from the contaminated soils.

Supplementary text

EXCESSIVE OXYGEN AND LIFE

Animal life emerged on our planet when the atmosphere was still very poor in oxygen. It is no wonder that living organisms had to adapt themselves to an environment where oxygen was in short supply. However, we usually fail to notice another much more puzzling phenomenon, namely that animals living in the presence of excessive oxygen have managed to restrain the intensity of the oxidation processes taking place in their bodies as if they were always ready to extinguish a constantly threatening fire.

The amount of environment oxygen is constant and, if it does alter, it decreases. This explains why animals have different means of combating oxygen shortages but no means of protection against excess oxygen.

Bert was the first to discover that breathing pure oxygen can be poisonous around a hundred years ago. This was such an unexpected discovery that scientists did not believe him and a suspicion arose that the oxygen used by Bert contained various poisonous admixtures. The experiments were repeated many times, but no matter how thoroughly the oxygen was purified, the animals which breathed it in for prolonged periods inevitably perished.

Exercise XXXI. Does the text supply information for answering the following questions?

Did living organisms have to adapt themselves to an environment where oxygen was in short supply? When did animal life emerge on our planet? What happens when the amount of environmental oxygen alters? Who was the first to discover that breathing pure oxygen can be poisonous? Did scientists believe Bert?

Exercise XXXIL «Body» quiz for biologists.

1. If all the blood vessels in your body were put end to end, how far would they reach?
2. If people talk without vibrating their chords what they be doing?

3. Gram for gram, which of the three is the strongest:
   a) human bone;
   b) reinforced concrete;
   c) marble.
4. How much saliva does a body produce a day?
   a) a cup or so;
   b) a liter or more.
5. Are many people bom with three eyes?
6. On which finger does a nail grow faster?
7. Do the tonsils have any function in our organisms?

Clues: whispering, a liter, bone, protect from infection, all people (pineal gland, it reacts to changes of light and adds to producing melatonin which affects our mood), 96,500 km.

Exercise XXXIII. Try some email writing. Please, be advised that these messages should be shorter than letters, and are normally written in the «block» style. Follow the example.

To: (write the email address of the recipient)
From: (write the email address of the sender)
Subject: (write the heading to the message)
C.c: (write the email address (addresses) where a copy of the message should be sent) Attachments: (attach the file with the text you want to send with the letter)

Use the layout of the «block letter» from Exercise XLVI of Unit Four. Notice the useful phrases as endings of business letters:

I look forward to hearing from you. Thank you for your time. Best regards. Best wishes. With the very best regards. Sincerely. Yours sincerely. Yours faithfully.

So, imagine that you saw an email classified advertisement and intend to send your mini resume in response. Go ahead!

To:
career.info@ktsu.ua.edu
From: mk.@itp-intl.com.ua
Subject: employment
C. c:

We are looking for Sales representative

Functions: sales of petrochemicals around Ukraine
developing and maintaining distributors network client service
Requirements: secondary/higher education strong
communicative skills fluent English
experience in sales is a plus driving
license

Please, send your resume to
mk@itp-intl.com.ua

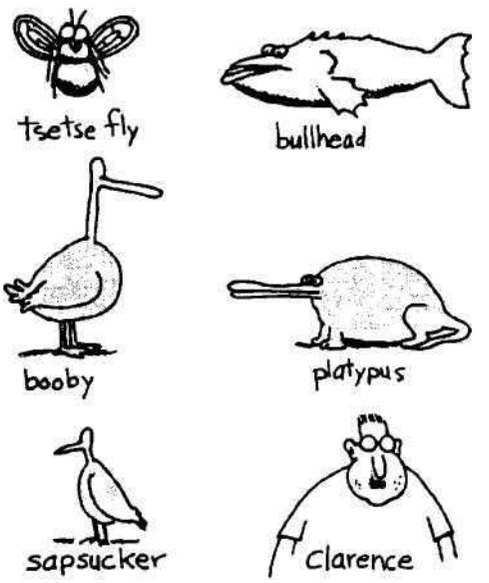
Now, it's your turn. Go ahead and organise your CV into the email message. Here is a mini resume as a model.

Male, 20, university student, majoring: chemistry, working experience: 1 year sales representative in foreign company, good English, basic German, PC, driving license, strong communication, analytical and organisational skills, creative. Willing to fmd a serious well-paid chemistry related job.

By the way, do you know what this «@» sign we all use in our email means? It depends on the country, you know... In English-speaking countries they call it «commercial at» or simply «at». In France and Italy they would call this sign «a little snail» or «a snail». The Swedish name is « an elephant ear» and the Finish see the sign as «a cat's tail». The German name seems to be the nicest of all: Klameraffe meaning «a spider monkey». What do we call it here in Ukraine?

Mini-Test

Just relax. No mini-test in this unit. Look at unfair animal names instead



Unit Eight

Exercise I. Pronounce:

picture
explain
relate
dense
surround
behaviour
gain
level
lose
emit
raise
permit
advance

Exercise II. Pronounce the following word combinations:

basic physical property
different electron pattern
positively charged nucleus
permitted energy level
wave-mechanical model
smallest possible unit

Text

THE ATOMIC THEORY

Keywords: *matter, theory, atomic concept, atomic structure, unit, indivisible, particle, electron, proton, periodic, recurrence, nucleus, radioactivity, energy, level, model.*

The theory of the structure of matter has been developing for more than 2,500 years. In 450 B.C., Democritus, a Greek philosopher, first proposed that matter is composed of atoms. Aristotle (384—322 B.C.), an influencial Greek scholar, never accepted the atomistic concept of matter.

John Dalton (1766—1844), a teacher of mathematics, physics, and chemistry was the first who proposed a formal statement of an atomic theory. He concluded that chemical compounds are formed by the combination of certain unit weights of the elements. The smallest possible unit he termed an atom; and he concluded that the atoms of the elements must vary in weight, these atomic weights being basic physical properties of the elements. The major points of his atomic theory were:

1. All matter consists of indivisible particles called atoms.
2. The atoms of a given element are alike.
3. Atoms cannot be divided into smaller parts.
4. Chemical changes result from the combinations of atoms of different elements.

Thompson proposed the model of the atom which was very useful because it represented the first attempt to introduce electrons into the atomic concept. Thompson stated that the periodic recurrence of similar properties of different elements was related to different electron patterns in the atoms.

Rutherford's model of the atom contained the following points:

1. The atom contains positively charged nucleus.
2. The nucleus is surrounded by electrons.

This model could explain radioactivity and atomic mass and it pictured the electrons, moving about the nucleus and explaining the chemical behaviour of elements.

The major contribution of the Bohr theory was the concept of «permitted» energy levels for the electrons.

Bohr's mathematical model of the atom reads as follows:

1. Electrons move about the nucleus at certain specific energy levels.
2. Electron neither gains nor loses energy within one energy level.
3. Energy of electrons is specified by the stable energy levels.
4. An electron jumps to a higher energy level, when an atom absorbs a photon.
5. Radiant energy is emitted, when an electron moves back to a lower energy level.
6. A photon is emitted, when an electron is raised to a higher energy level and then moves back to a lower energy level.

The major advances in the development of the atomic theory have been the result of personal effort and imagination.

The latest theory for the atomic structure is purely mathematical and is referred to as the wave-mechanical model.

VOCABULARY AND COMPREHENSION

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

1. Who first proposed that matter is composed of atoms? 2. What did Dalton propose? 3. Why was Thompson's model of the atom useful? 4. What points did Rutherford's model of the atom contain? 5. What kind of the atom model did Bohr propose? 6. How is the latest theory for the atomic structure referred to?

Exercise IV. In what line of the text do you read:

1) that Aristotle, an influenced Greek scholar, never accepted the atomistic concept of matter; 2) that Dalton concluded that chemical compounds are formed by the combination of certain unit weights of the elements; 3) that Thompson stated that the periodic recurrence of similar properties of different elements was related to different electron patterns in the atoms; 4) that the major advances in the development of the atomic theory have been the result of personal effort and imagination.

Exercise V. *Note carefully synonyms for each of the following words.*

Explore	-	to examine, investigate.
Propose	-	to put forward for consideration.
Compose	-	to make up, arrange.
Represent	-	to make out to be, symbolise.
Introduce	-	to bring in or forward.
Relate	-	to establish relation between, to have reference or relation to.
Emit	-	to give out, release.

-

Exercise VI. *Write down definitions of the following terms.*

Structure of matter, chemical compound, atomic weight, physical property, chemical change.

Exercise VII. Read and translate the following words and word combinations.

Compound — stable compound, isomeric compound, covalent compound, known compound, binary compound, ternary compound, ionic compound, simple compound.

Change — nuclear change, subatomic change, phase change, temperature change.

Energy — radiant energy, specific energy, nuclear energy, potential energy, kinetic energy, sufficient energy, definite energy, ionisation energy, electrical energy, static energy.

Structure — molecular structure, atomic structure, isomeric structure, X-ray structure, complex structure.

Exercise VIII. Write down all the actions chemists can do with:

1. Compound; 2. Weight of compound; 3. Energy level; 4. Atomic structure.

Exercise IX. Find English equivalents for the following Ukrainian word combinations.

Формальне твердження
Неподільна частка
Періодичне повторення

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

To result in — закінчувати, приводити (до чогось), давати.

To result from — виходити з, виникати.

1. Interactions between molecules often result from the unequal sharing of electrons in the covalent bonds. 2. The process of solvation results in the attachment of the solvent molecule to the cation, the anion, or a molecule of a solute, either by coordination or by hydrogen bonding. 3.The assumptions made by various chemists as to the number of atoms, which combine to form a compound, resulted in different values for the atomic weight.

Exercise XII. Choose the words that best complete the statements.

1. The theory of the structure of matter has been developing for _____than 2,500 years.
   a) more
   b) less
2. W**e** will explore the chronological development of the modem atomic theory for the structure of matter.
   a) briefly
   b) fully
3. The atoms of a given element are _____in every respect, especially mass.
   a) different
   b) alike
4. The model of the atom proposed by Thompson was_____ .
   a) useless
   b) useful
5. The atom contains _____ charged nucleus.
   a) negatively
   b) positively
6. When an atom absorbs a photon, an electron jumps to a _____ energy level.
   a) lower
   b) higher

Exercise XIII. Determine whether each of the following statements is true or false.

1. Aristotle, an extremely influential Greek scholar, was the first who proposed that matter was composed of atoms. 2. John Dalton stated that all matter consisted of visible particles. 3. Thompson's model of the atom represented the first attempt to introduce electrons into the atomic concept. 4. Rutherford's model of the atom could explain the chemical behaviour of elements. 5. According to Bohr's model of the atom within one energy level electron can gain or lose energy.

WORD-BUILDING

Exercise XIV. Form nouns from the verbs with the help of the suffixes.

-ment:	to state, to move, to develop;
-tion:	to combine, to propose, to represent, to introduce, to explain, to contribute, to absorb, to imagine;
-sion:	to conclude, to divide, to emit.

Exercise XV. Study how to write compound words. If in doubt, consult a dictionary. The dictionary will tell you whether to treat a compound word as a hyphenated compound (water-repellent), one word (watertight), or two words (water composition). If a compound word is not in the dictionary, treat it as two words.

Use a hyphen to connect two or more words functioning together as an adjective before a noun (well-known scientist).

Use a hyphen with the prefixes all- (all-union), ex- (ex-president), self- (self-help) and suffix -elect (president-elect).

Use a hyphen in fractions and compound numbers from twenty-one to ninety-nine (one- third, thirty-nine).

Do not use a hyphen between -ly adverbs and the words they modify (a slowly reacting substance).

Edit the following sentences to correct errors in hyphenation, if any.

1. Gold is the seventy ninth element in the periodic table. 2. America has rich pre- Columbian history. 3. One-quarter of our students know two foreign languages. 4. He is a wellknown long distance runner. 5. Self-respect is very important for an individual. 6. This substance has excellent acidproof characteristics.

Always check a dictionary for the standard form of the word.

Exercise XVI. Be alert to using B. C. (or BC), A. D. (or AD), A. M., P. M., No., and $.

The abbreviation B.C. («before Christ») follows a date and A.D. («anno Domini») precedes a date. Alternatives are B.C.E. («before the Common Era») and C.E. («common era»).

4 B. C. (or B. C. E.)	5:00 A. M. (a. m.)	No. 10 (or no. 10)
A. D. 40 or (C. E.)	6:00 P. M. (p. m.)	$ 100

Avoid using these abbreviations when they are not accompanied by specific figures.

Edit the following sentences for the problems with abbreviations, if any.

1. America was discovered in B. C. 1492. 2. Some researchers think that this manuscript dates back to 100 A. D. 3. You should send $100 as the non-refundable fee with your application form. 4. The mineralogy lecture will begin at precisely 1:30 P. M.

GRAMMAR STRUCTURE

Punctuation
Indirect (embedded) questions
Review of the Past Simple Tense in Narration

Punctuation marks are very important as they help a reader to understand a text better. Without commas, for instance, a reader would have to go back and reread a sentence to understand what a writer meant. You have to put commas before ***and, but, for, or, nor, yet, so,*** *when they connect two independent clauses. Put commas between items in a series. Put a comma after an introductory expression* ***well, moreover, finally, additionally,*** *etc. Put commas after a dependent clause:* ***when cooling the substance, crystals may form,*** *otherwise the reader might read* ***when cooling the substance crystals*** *... Put commas around an expression that interrupts the flow of the sentence:* ***however, therefore, of course, finally, by the way, on the other hand, I am sure, I think,*** *etc.*

Such expressions are most likely to be interrupters, if they are in the middle of the sentence. At the beginning of the sentence they do not often require commas.

Here are the names of the punctuation marks in English: comma (,), colon (:), question mark (?), dash (—), hyphen (-), apostrophe (‘), semi-colon (;), exclamation mark (!), slash (/), brackets (), quotation marks («»), full stop/period.

*Put a question mark after a question, but not after an indirect question. Follow the direct word order in an indirect question: «****Where do you study?****» but* ***He asks us where we study.***

Narration. Favourite Tense of Narration: Past Simple
Positive, Negative and Interrogative Verb Forms in the Past Simple Tense

Positive	Negative	Interrogative
I	**I**	**I**
You	**You**	**you**
He	**He**	**he**
She worked	**She did not work**	**Did she work?**
We	**We**	**we**
They	**They**	**they**

Paragraphs can be organised in many various ways, but most frequent, alone or in combination, are examples and illustrations, narration, description, process, comparison and contrast, analogy, cause and effect, classification and definition. A paragraph of narration tells a story or a part of a story. It is usually organised in chronological order, whence a wide usage of the Past Simple Tense.

Exercise XVII. Rewrite the following sentences in the Past Simple.

1. Many of the very early ideas are the result of thinking rather than of experimentation. 2. Dalton has some information about many different substances. 3. Dalton’s work gives the scientific world a conceptual scheme, which was both simple and workable. 4. Torricelli comes to conclusion that we live at the bottom of a sea of air. 5. Dalton finds by his methods that the formula for water could be H_20, $H0_2$ or HO.

6. In 1896, Henri Becquerel, a French chemist, makes a chance discovery. 7. Rutherford does extensive work on radioactivity. 8. Huggens thinks that light is composed of waves. 9. The wave mechanical model becomes the accepted model for the atom. 10. Einstein says that the quantum idea can be applied to radiation through a vacuum. 11. Niels Bohr, a Danish physicist, goes to work in Rutherford's laboratory.

Exercise XVIII. Open the brackets choosing the correct form of the verb.

1. George Stahl (*studied, studies, study*) the phenomena of combustion. 2. In 1772 Lavoisier *(demonstrates, demonstrate, demonstrated)* the true nature of combustion. 3. Lavoisier *(find, found, finds)* that the oxidation of metals resulted in an increase of weight. 3. J. L. Proust, a French chemist, *(is able, was able, were able)* to show that a definite chemical compound always contains the same elements combined in the same proportions by weight. 5. In the second half of the nineteenth century the main advances in chemistry *(was, were, are)* in the synthesis of new carbon compounds. 6. In 1977, C. Friedel and J. Crafts *(discover, discovered, discovers)* the reaction that is known by their names. 7. C. Guldberg and P. Waage *(stated, state, states)* that the velocity of a reaction at constant temperatures is proportional to the product of the active masses of the reacting substances.

Exercise XIX. Transform the past affirmative statements into past simple questions.

1. E. Rutherford (1871—1937), a New Zealand physicist, did extensive work on radioactivity. 2. In 1913, F. Soddy and T. W. Richards of Harvard University discovered two different atomic masses for lead. 3. Thompson discovered neon atoms, which had different masses. 4. James Chadwick demonstrated die presence of a neutral particle in the nucleus of atoms. 5. Isaak Newton and Christian Huygens proposed conflicting ideas about the nature of light. 6. In 1960 James Clerk Maxwell developed a model for light. 7. In 1888 Heinrich Herts, a German scientist, who produced radio waves, confirmed the existence of electromagnetic waves. 8. In 1890 Max Plank, a German physicist, proposed that radiation was emitted in tiny packages. 9. The major contribution of the Bohr theory was his energy level model for the atom.

Exercise XX. Pick out the sentences in the Past Simple Active.

Friedrich Wohler was a German chemist who studied medicine in Germany and chemistry in Sweden. He is best remembered for his preparation in 1828 of urea from ammonium chloride and lead (II) cyanate. This was the first synthesis of an organic compound from inorganic substances. In 1827, Wohler was the first person to prepare aluminium metal in a pure form and to describe its chemical properties. He made aluminium by reacting aluminium chloride with potassium metal.

$AlCl_3 + 3K = Al + 3KCl$

Exercise XXI. Make up sentences using the following words.

1. The influence / Dalton's work / on / was / very / great / of / science *I.* 2. Gay-Lussac / that / gases / all / with / other / each / assumed / combine/. 3. Pierre and Mary Curie / from / radium / radioactive / isolated / uranium / ore /. 4. H. Mosely / the wave / of / the / X-rays / lengths / measured/. 5. The discovery / neutron / made possible / the nature of / an explanation / of / the isotopes /. 6. In 1916 / worked out / A. Lewis / of / valence / theory / the electron/.

Exercise XXII. Substitute English words for the Ukrainian ones.

1. You (записали) some properties of these elements at our previous lessons. 2. You (встановили) which elements reacted similarly. 3. Yesterday you (вивчили) that calcium, barium, strontium and magnesium formed a family. 4. What you (засвоїли) last week will help you to write formulas and equations and to predict other information.

5. In such conditions each compound (реагував) to form other stable compounds. 6. When a substance (втратило) electrons, it (утворило) a positive ion. 7. The discovery of the neutron (уможливило) an explanation of the nature of the isotopes. 8. In 1913 H. Mosley (встановив) the wave length of the X-rays emitted by various elements. 9. At that time many chemists (приділяли) their attention to the velocity of reactions.

Exercise XXIII. Translate the following sentences.

1. Авогадро, італійський фізик, запропонував, що одиниці газу були не атомами, а молекулами. 2. Відкриття Рентгеном х-променів було найбільш важливим досягненням того часу. 3. Бекерель встановив, що уранова руда випромінює проникаючу радіацію, що впливає на фотографічну пластинку. 4. У 1913 році Фредерік Соді відкрив дві різні атомні маси свинцю. 5. У 1860 році Кларк Максвелл розробив модель світла. 6. У 1900 році Макс Планк припустив, що радіація випромінюється у вгляді крихітних пучків.

Exercise XXIV. Add the necessary punctuation marks to the following sentences.

1. The four largest moons are named Io Europa Ganymede and Callisto. 2. Because they were discovered by Galileo they are called Galilean moons. 3.The most surprising discovery of Voyager 1 however was a ring around Jupiter. 4. Astronauts can someday land on Mars but they can never land on Venus because of extremely high temperature. 5. Therefore unmanned spaceships with robots will be sent to such planets. 5. Do you know what was the first helicopter. 6. I wonder what the first helicopter looked like. 7. Before the Europeans came to the country America was a land of incredibly rich natural resources. 8.1 wonder what is the biggest animal on the earth.

Exercise XXV. *Change direct questions given below into indirect ones. Use the following expressions to begin your indirect questions: «I wonder» and «I am not sure».*

1. Where does he live? 2. When did he send us this letter? 3. How much do they earn? 4. Why didn't you call us yesterday? 5. How many mistakes did you make in your yesterday's test? 6. Who left a message for you? 7. What do you know about this event? 8. Who left a lot of his money to promote simplified spelling of the English language? 9. What did they say about their plans?

SCIENTIFIC COMMUNICATION

Exercise XXVI. Insert the missing words from the list given below: classic, basis, published, thermodynamics, influence, devoted, subject, performed.

ALBERT NEWTON LEWIS, 1875—1946

Lewis ... most of his career to the understanding of the structures of molecules and of thermodynamics. His thinking was far ahead of his time and his theories had profound ... on chemistry. His understanding of chemical bonding influenced modem thinking on this ... Lewis was one of the first to recognize that energy effects provide a ... for predicting what chemical reactions can occur. Thus, he awakened chemists to the crucial importance of ... His book on this subject published in 1923 became a ... of the chemical literature. He ... over 150 research publications on topics extending from the phases of sulphur to quantum mechanics. He favoured simple and direct experiments and ... many of his important discoveries with a few test tubes and simple chemicals.

Exercise XXVII. Write English equivalents of the words in brackets. Be sure that you understand the text.

The nature of heat (привертала) little attention in ancient times. The first chemist who studied heat (систематично) was Joseph Black, a chemist of Glasgow. He (спостерігав) that when ice (танув) it absorbed heat without undergoing any (зміни) in temperature; and Black named the heat which (зникає) in the process latent heat. Black (показав) that in the melting of ice, heat was absorbed equivalent to that made available by the cooling of an equal mass of water through 140° Fahrenheit. Black also (відкрив) that heat is used in the (випарюванні) of water. It (потрібно було) nearly seven times as much heat to change a pound of water into steam as to melt a pound of ice.

Exercise XXVIII. Complete the following sentences.

1. Matter is composed of ... 2. The differences between atoms of different elements are due to ... 3. The mass of the atom is concentrated almost entirely in ... 4. The chemical properties of different elements can be explained by... 5. The activity of metals and non-metals is related to ... 6. The valence or combining capacity of an atom is determined by ... 7. Atoms may be joined to other atoms to show ... 8. Chemists construct models of molecules to show ...

Exercise XXIX. Give a written translation of the following text.

Демокріт вважав, що матеріальний світ складається із маленьких частинок, які він назвав атомами, що означає «неподільні». Він створив нове вчення — атомістику, і надав атомам таких «сучасних» властивостей як розмір, форму та здатність рухатися. Епікур продовжив вчення Демокріта й припустив, що атоми мають внутрішнє джерело руху та можуть взаємодіяти один з одним.

Потім вчені надовго забули атомістику. Тільки у 17-му сторіччі П'єр Гассенді відродив це вчення та систематизував ідеї та думки старогрецьких філософів.

Відродження атомістики збіглося у часі із відкриттям Р. Бойлем (1627—1691) фундаментального закону, що визначає залежність об'єму газу від тиску. Саме гази допомогли сформулювати основні положення атомно-молекулярного вчення. Але до цього моменту залишалося ще 100 років.

Exercise XXX. Use the words and phrases supplied below to make up extensive answers to the questions.

1. What are the major points of Dalton's atomic theory? (to be alike, to be divided, to result from, to determine the mass of elements, indivisible particles, the combination of atoms).
2. What model of the atom was proposed by Thompson? (first attempt, to introduce electrons, atomic concept, periodic recurrence, similar properties, electron patterns).
3. What are the principal characteristics of Rutherford's model of the atom? (to be surrounded, a large region of space, the concept of a positive nucleus, to explain radioactivity, the chemical behaviour).
4. How does Bohr's model of the atom read? (specific energy levels, to gain energy, to absorb a proton, radiant energy, the concept of «permitted» energy levels).

Exercise XXXI. John Dalton thought the formula for water was HO (half a century passed before the present formula for water was generally accepted). What relative weights did he then obtain for weight of oxygen and hydrogen atoms?

Exercise XXXII. Say why Dalton's model of the atom was modified

Exercise XXXIII. List reasons why Dalton's work was important to the development of science.

Exercise XXXIV. Describe the usefulness of Thompson's model of the atom. Exercise XXXV. State the major contribution of Rutherford to the development of the modern atomic theory.

Exercise XXXVI. Describe the experiment that led Rutherford to propose the nuclear model for the atom.

Exercise XXXVII. Translate the parody poem into Ukrainian and then into scientific description of Bohr's model of an atom.

THE ATOM THAT BOHR BUILT

(with apologies to Jack)

This is the atom that Bohr built.
This is the nucleus That sits in the atom That Bohr built.

This is drop that looks like the nucleus That sits in the atom That Bohr built.

These are the compound levels galore That make up the spectrum That's due to the modes That belong to the drop That looks like the nucleus That sits in the atom That Bohr built.

This is the shell and this is the core That possesses the compound levels galore That make up the spectrum That's due to the modes That belong to the drop That looks like the nucleus That sits in the atom That Bohr built.

This is the correspondence (as Bohr said before)
That holds in the shell, as well as the core That possesses the compound levels galore That make up the spectrum That's due to the modes That belong to the drop That looks like the nucleus That sits in the atom That Bohr built.
This is the complementarity law
That gives correspondence (as Bohr said before)
That holds in the shell, as well as the core
That possesses the compound levels galore
That make up the spectrum
That's due to the modes
That belong to the drop
That looks like the nucleus
That sits in the atom
That Bohr built.

This is the day we celebrate Bohr
Who gave us the complementarity law
That gives correspondence (as Bohr said before)
That holds in the shell, as well as the core
That possesses the compound levels galore
That make up the spectrum
That's due to the modes
That belong to the drop
That looks like the nucleus
That sits in the atom
That Bohr built.

Exercise XXXVIII. Comment on the usefulness of studying the development of the atomic theory in a historical aspect.

Exercise XXXIX. Restore questions to the following text.

Pierre Curie and his wife isolated from the residues of uranium ore the strongly radioactive radium, of which the atoms were decomposing and changing into atoms of lower atomic weight. Madam Curie and her husband studied salts of different elements and discovered that thorium would produce an effect on a film in the same way that uranium did and that the activity of different thorium and uranium ores differed. The tests finally indicated that the natural uranium ore known as pitchblende contained something highly active. Monsieur and Madam Curie undertook to analyze systematically about a ton of pitchblende ore, testing all the products at each step for their activity. This resulted in the isolation of two residues, in one of which the barium of the pitchblende was isolated and in the other, the bismuth; these residues were forty or sixty times more active than uranium. Normal barium and bismuth showed no activity, so that it was concluded that these residues contained substances that were chemically very similar to barium and bismuth.

Exercise XL Entitle the following text, and match topic sentences with corresponding paragraphs.

There are ninety-two naturally occurring elements in the periodic table, ranging from hydrogen, whose atoms have just one proton in the nucleus, to uranium, whose atoms have ninety-two. In the past half-century, physicists created twenty-three more elements, having more than 92 protons. Those, so called transuranium elements, have various uses. Americium (element 95), for instance, is a key component in smoke detectors, whereas plutonium (element 94) is the main explosive in atom bombs.

The research team from Lawrence Berkeley National Laboratory discovered elements 116 and 118 by calculating collisions between krypton ions and lead targets. These newest man-made elements existed for less than the blink of an eye: element 118 decayed within a millisecond, and element 116 existed only about five times that long. Such creations are usually too unstable to be studied. But not long ago, Russian researchers from Dubna announced the creation of element 114, which lived rather long — for about thirty seconds.

The latest discoveries excited nuclear chemists and physicists about the possibility that the so-called island of stability may soon be reached. The theory predicts that if elements having approximately 114 protons and 184 neutrons could be produced, they would have life long enough for the investigation. Berkeley group believes that if a bismuth target is used instead of the lead one, element 119 may soon be discovered.

Topic sentences:

1. Berkeley research team discovers new transuranium elements.
2. Twenty-three new elements were discovered in the past fifty years.
3. Researchers expect that the island of stability for the transuranium elements will be soon reached.

Supplementary Text

JONS JAKOB BERZELIUS

Jons Jakob Berzelius was the organiser of the science of chemistry. He was a medical man, teacher, and, finally, a professor of chemistry at the College of Medicine in Stockholm. He introduced the system of chemical nomenclature of the symbols for elements and formulas for compounds, and developed a great skill in chemical analysis, as a result of which he determined the atomic weights of the elements with such precision that his determinations were not superseded for many years.

The analytical work in which Berzelius displayed such a surpassing skill could, of course, determine only the combining equivalents of the atoms. The assumption made by various chemists as to the number of atoms, which combine to form a compound, resulted in different values for the atomic weight.

If, as it was easiest to believe, one atom of hydrogen combined with one atom of oxygen to form water, the atomic weight of oxygen was 8. The solution of the difficulty could have been found in the hypothesis of Amadeo Avogadro, who introduced the idea of a molecule as the smallest part of a substance.

Many chemists turned their attention to the velocity of reactions, which soon centred on the phenomenon of catalysis. This term had been introduced by Berzelius for reactions, the velocity of which was greatly increased by the presence of small amounts of foreign substances that apparently took no part in the reaction and underwent no changes.

Exercise XLI The author is primarily concerned with:

a) the biography of Jons Berzelius;
b) the contribution made by Jons Berzelius to chemistry;
c) the growth of scientific knowledge;
d) the method of science.

Exercise XLII. Which of the following is not mentioned in the text:

a) the system of chemical nomenclature introduced by Berzelius;
b) the term «catalysis» introduced by Berzelius;
c) the determination of the atomic weights of the elements made by Berzelius;
d) the methods used by Berzelius in his research work.

Exercise XLIII. Does the passage supply information for answering the following questions?

a) What was the contribution made by Berzelius to chemistry?
b) What scientific facts did the scientist assemble?
c) What are catalytic reactions?
d) Was the problem of the atomic weights of the elements solved in its present form?

Exercise XLIV. All of the following can be found in the text except:

a) berzelius introduced the system of chemical nomenclature;
b) berzelius developed great skill in chemical analysis;
c) berzelius introduced the term «catalysis» for some reactions;
d) berzelius proved the interdependence of fact and theory.

Exercise XLV. Write a plan of the text, supplying headings to each paragraph.

Exercise XLVI. Write in an encyclopaedia manner about J. Berzelius biography.

Exercise XLVII. Discuss the following text. What do you know about the history of your faculty or the university? What famous scientists studied and worked there?

ON THE HISTORY OF CHEMISTRY IN UKRAINE

The foundation of Kharkiv University in 1805 had a great impact on the development of chemistry in Ukraine. A special course on this subject was taught at the department of physics and mathematics. Lectures were delivered in Latin.

At that time chemists were mostly interested in analytical chemistry and mineralogy. The science had an applied character and paid much attention to the manufacture of glass, dyes, sugar and to the analysis of raw materials.

The five-volume «General Chemistry for Teachers and Students» was the first textbook on chemistry published in Ukraine.

The author of the book F. Gize was the head of the department and the most famous chemist in Ukraine at that time. Professor Gize initiated reading lectures on organic and pharmaceutical chemistry in Kharkiv University. In 1856, N. Beketov was appointed the head of the department of chemistry. He was an outstanding scientist and a talented lecturer. Professor Beketov's works greatly influenced the development of chemistry in Ukraine. The sphere of his scientific interests included general regularities of chemical processes and metallic properties of hydrogen.

He was the first to state that a lighter body displaced a heavier one in the reaction and that the specific gravity was the main factor for the direction of any reaction.

In 1865 professor Beketov established the series of metal reactivity later proved by G. Lewis and M. Rendal. N. Beketov's important discovery was aluminothermia, i.e. metal reduction by means of aluminium. This method was later used in metallurgy.

Exercise XLVIII. Have fun. Read the informal email message about a student slang project. Write your letter in return. Use the reference list of student slang words and expressions given below.

To: pbrick@hotmail.com
From: ady@nyu.edu
CC:
Subject: student slang project

Hi, dude,
Wanna take part in our project? If you don't wanna be ragged on for bein' old skool, and talk like a turkey, you better hang out here.
Pass the bone and tell us the jive from your college. Are you slanging there too?
Wanna know more? Write to Joe Laert, project manager: jlaert@hotmail.com

I'll gonna bounce or I'll be late for classes.

Bye.

Peter.

Reference list of student slang (hot words in 2,000):

Airhead = stupid, stupid person
Antifreeze = alcohol
Beans = money
Boo boo = a mistake
Bounce = to leave
Cool = great, good, awesome
Crip = house
Da bomb = the best, very good «Dead presidents» = money
Dis = this
Dog = friend, foot, lier Drop = to tell, to give Dude = a
person, male, friend Faded = drunk
Hang out = to relax, to get together Helia = very
Hip = in style, knowledgeable
Hep cat = somebody who is in style
Get outta here = you must be kidding
Jam = to leave, to go
Jive = words, jokes
Old skool = not hip, over 5 years old

Pass the bone = to share knowledge or experience
Rag = to critisize, tease
Rents = parents
Ride = a car
Trip = strange, to outrage, disagree Turkey = stupid person
Wassup = hi, what's up Yo = what's up

Here are some examples: my dogs are barking = my feet are hurting; that party was da bomb = was very good; that dude's trip = that guy is strange; he tripped when I told him the story = he became outraged; he is my dog = he is my friend; my professor dogged me = critisized me; kick it back = relax

Exercise XLIX. Do some physics at home, entertaining your younger brothers or sisters.

#1. Fill the glass two-thirds full of water. Place a pencil in the glass, holding it straight up. It will still appear straight if you look from the side. Now allow the pencil to lean against the glass side. View from the side. The pencil appears bent. What optical effect are you observing?

#2. Take a glass of water or cola. Hold a straw vertically in the glass. Don't let the end of the straw to touch the glass bottom. With your second hand hold the second straw horizontally with its end in your mouth. The second straw should be adjacent to the vertical one, forming 90-degree angle with it. Now blow hard. If your straws are set up properly, your blowing should raise liquid up in the vertical straw. When it reaches the top, it will spew out giving an atomiser effect. Why? Explain.

(The tip: blowing through the horizontal straw creates a low-pressure zone. So what?) (Source: *www.doscience.com*)

Unit Nine

Exercise I. Pronounce the following word combinations:

identify element
study property
make attempt
predict existence
observe periodicity
make conclusion
reveal fact

Text A

THE PERIODIC LAW

Keywords: *identify, classify, predict, discovery, dependence, periodicity, function, atomic weight, atomic number, proton, nucleus.*

In the eighteenth century many chemists began to identify elements and study their properties. A lot of attempts were made to classify them. The most outstanding classification was made by the Russian chemists Dmitry Mendeleev, who in 1869 published his Periodic Table of Elements, based on the discovery of the law of dependence of the properties of the elements on their atomic weights. Mendeleev noticed that if he arranged the elements in order of increasing atomic weight, definite chemical properties repeated themselves periodically. His table of the known elements was constructed with seven elements in each of the first two rows and seventeen elements in each of the next two rows. But there were several blank spots in his table of those elements, which had not been discovered at that time. Mendeleev predicted their existence basing on the observation of periodicity. He even called them ekaboron, ekaaluminum and ekasilicon. Finally, the discovery of gallium was followed by the discovery of scandium in 1879. And the discovery of germanium was made in 1886. Mendeleev's table revealed the fact that properties of the elements are periodic function of their atomic masses. This statement was called the Periodic Law. Later, Mosley made a conclusion that each element had a characteristic number of protons in its atomic nucleus and that it would be better to classify elements according to their structure. And now the Periodic Law reads as follows: the physical and chemical properties of the elements are periodic functions of their atomic numbers. The elements in the modem Periodic Table are arranged in order of increasing atomic numbers. The value of the Periodic Table consists in the fact that by grouping the elements into families and knowing the trends within these families, chemists can predict the properties of their compounds.

VOCABULARY AND COMPREHENSION

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

1. When did chemists begin to identify elements and study their properties?
2. By whom was the most outstanding classification made?
3. When did Mendeleev publish his Periodic Table of Elements?
4. What was his Periodic Table based on?
5. What did Mendeleev notice?
6. How was Mendeleev's Table constructed?
7. Did Mendeleev predict the existence of undiscovered elements?
8. When was germanium discovered?

9. What fact did Mendeleev's Table reveal?
10. What conclusion was made by Mosley?
11. How does the Periodic Law read?
12. What is the value of the Periodic Table?

Exercise III. In what line of the do text you read

1) that a lot of attempts were made to classify elements; 2) that the most outstanding classification was made by the Russian chemist Dmitriy Mendeleev; 3) that Mendeleev noticed that definite chemical properties of elements repeated themselves periodically; 4) that Mendeleev's table revealed the fact that properties of the elements are periodic function of their atomic masses; 5) that the elements in the modem Periodic Table are arranged in the order of increasing atomic numbers.

Exercise IV. Note carefully definitions of each of the following words.

Compound - a substance composed of two or more elements chemically combined.
Element - a substance made up of only one kind of atom.
Property - any identifying characteristic of a substance such as colour, taste and so forth.
Classify - to arrange methodically in classes.
Weight - a heavy mass, an object of known mass for weighing.
Observation - action or habit of observing; noticing.

Exercise V. Write down the definitions of classification, periodicity, statement.

Exercise VI. Choose the one word that best keeps the meaning of the original sentence.

1. Elements with *similar* electron patterns have similar properties.
   a) resembling
   b) different
   c) various
   d) same
2. The first attempts to classify elements were *crude.*
   a) considerable
   b) simple
   c) rough
   d) gentle
3. Mendeleev *assumed* that blank spots in his table indicated elements, which had not been discovered.
   a) took for granted
   b) thought
   c) decided
   d) supposed
4. The modem periodic table is an *attempt* to group elements according to properties.
   a) decision
   b) idea
   c) effort
   d) example

Exercise VII. Translate the following sentences. Be sure that you know the meanings of the following words:

Order — порядок, послідовність, наказ, замовлення.
In order to — для того щоб.
In order of — у порядку.

1. Experimental data obtained in the laboratory should be recorded in a table in order to read them easily. 2. The atoms of elements may be arranged in different ways in order of forming molecules of different types of matter. 3. While the order in which the attitudes and procedures are used may vary widely, there are overall patterns that are characteristic of laboratory investigation. 4. The particles, which compose crystal, are arranged in an identifiable order. 5. Solids have lower energy and greater order than liquids. 6. In order to understand more recent developments in the atomic theory, it is necessary to know something about radiant energy. 7. As the chemical elements were identified and their atomic weights were determined, it became possible to discern a sort of order in their properties.

Exercise VIII.. Which of the following statements is false?

The atoms of oxygen differ from the atoms of every other element in the following ways: a) the nuclei of oxygen atoms have a different number of protons than the nuclei of any other element; b) atoms of oxygen have different chemical behaviour than do atoms of any other element; c) atoms of oxygen have a higher ratio of neutrons to protons than the atoms of any other element; d) neutral atoms of oxygen have a different number of electrons than neutral atoms of any other element.

Exercise IX. Translate the following sentences into English.

1. Елемент визначається як речовина, яка не може бути поділена на різні типи матерії. 2. Елемент — найпростіша форма речовини. 3. Елементи часто називаються будівними блоками світу. 4. Елементи можуть класифікуватися як метали та неметали на основі їх властивостей. 5. При кімнатній температурі більшість елементів — тверді речовини. 6. Хіміки позначають елементи символами, складеними з однієї чи двох літер. 7. Багато елементів було відкрито сотні років тому. 8. Деякі елементи мають подібні властивості й можуть утворювати сім'ї. 9. Не всі елементи однієї сім'ї мають схожі властивості.

WORD-BUILDING

Exercise X. Combine nouns given below to form word combinations, where the nouns appearing before the other nouns function as adjectives.

A. Chemistry, carbon, gold, diamond, distillation, X-ray, substance, metal.
B. Professor, compound, watch, ring, device, analysis, property, lustre.

Be aware of the fact that the nouns that function as adjectives are always singular. Be alert to hyphenating a number-noun combination: «they took a three-week vacation».

Exercise XI. Form verbs by adding the prefix re-. Translate these verbs.

To arrange, to group, to construct, to operate, to make, create, view, consider.

Exercise XII. Translate the words of the same root. Construct a «word-flower» of «to observe» derivatives.

a) define, definite, definitely, definition, definitive; b) observe, observable, observance, observation, observational, observatory, observer; c) period, periodic, periodical, periodically, periodicity.

Text B

ANALYTICAL CHEMISTRY

Analytical chemistry is a branch of chemistry involved in the analysis of chemical substances. Analysis is used here in a broad sense to include identifying substances, called qualitative analysis; determining the concentration or amount of substances, called quantitative analysis; and determining the structure of substances. The theory on which the processes of analysis are based and the instrumentation or tools with which measurements are made are integral parts of the analytical chemist's domain.

The variety of problems in which analysis plays a role is indeed great. Below are listed six broad areas in which analytical chemistry is commonly involved.

1. Conducting research. Analytical chemistry plays a major role in many research projects. Following the accumulation of pesticides in the food chain or the metabolic fate of drugs in the human body, determining the nature of catalytic surfaces necessary to convert coal to natural gas, looking for new ways to separate, identify, and determine the concentration of important enzymes and proteins, and developing new and better instruments for making quantitative measurements are but a few examples.

2. Relating properties to composition or structure. Both the physical and chemical properties of alloys, adhesives, lubricants, plastics, and so on, depend on their chemical composition.

Similarly, the activity or effectiveness of pharmaceuticals, pesticides, and herbicides depends largely on their chemical 'structure.

3. Establishing economic value. Determining the amount of silver in a coin, the amount of oil in shale, and the amount of protein in animal feedstock are examples.

4. Determining health hazards. Establishing the concentration of sulphur dioxide in emissions from a coalbuming power plant and the amount of pesticide residue on fresh fruit and vegetables are two diverse examples.

5. Diagnosing disease. Clinical determinations such as those for glucose and urea are absolutely essential to the physician in making a proper diagnosis and making it quickly. Many clinical laboratories are set up to determine more than 50 substances routinely.

6. Controlling quality. Virtually all manufacturers try to achieve a constant, predetermined quality of a product. To do this they often need to know the quality of their raw materials. Drug and processed-food manufacturers must analyse their starting materials, additives, and finished products regularly to ensure that the product meets acceptable standards.

It should be obvious that analytical chemists often work in close Cupertino with other types of chemists and scientists. Consider, for example, a chemical manufacturing plant that suffers a large explosion. Management wants to know the cause of the explosion. Engineers will be called upon to assess the damage, estimate the force of the explosion, and try to pinpoint its source. They may also establish the effect of different types of equipment failure or malfunction. Organic or inorganic chemists will be called upon to determine what improper conditions or impurities could have resulted in undesirable reactions leading to explosive products. Physical chemists will be needed to calculate the amount of explosive energy that could result from the various possible reactions.

Analytical chemists may work with all of these scientists, analysing residue samples from around the explosion site to identify the combustion products in hopes that they will provide a clue as to the nature of the explosion reaction and/or the location of the explosion. Also, they might decide to analyse the raw materials being used to determine if impurities are present that could have been responsible for an undesirable reaction or condition that might lead to an explosion. The effectiveness of the scientists and engineers in solving this problem will be diminished if their knowledge is limited solely to their own disciplines. The extent to which we know things beyond our own discipline is important in determining our effectiveness in many endeavours both scientific and non-scientific. And it is, of course, the reason many of you are enrolled in an analytical chemistry course.

GRAMMAR STRUCTURE

Review of the Past Simple Tense/Passive
Affirmative and Negative Agreements

	Positive	**Negative**	**Interrogative**	
Passive	**I** **He** **She was asked It** **We** **You were asked** **They**	**I** **He was not asked** **She** **It** **We** **You were not asked** **They**	**Was** **Were**	**I** **He asked** **She** **It** **We** **You asked** **They**

Exercise XIII. Replace the infinitives in brackets by verbs in an appropriate form.

1. In the nineteenth century evidence for the existence of atoms (to be established) well. 2. Little (to be known) about the structure of the atom itself. 3. During the later part of the nineteenth century, the behaviour of gases canying an electric current (to be investigated). 4. Since the negative pole of an electric cell (to be called) cathode, these rays (to be named) cathode rays. 5. A series of experiments to investigate these cathode rays (to be performed) by J. Thompson, an English physicist. 6. In his experiments Thompson found that when light strikes metals, negatively charged particles (to be given off) by the metal. 7. The size of atoms (to be determined) roughly, but little (to be known) about their internal structure. 8. The nature of X-rays (to be studied) by Henry Becquerel, a French chemist.

Exercise XIV. Translate the pairs of sentences; notice distinctions in active and passive sentence structures.

I. 1.The most outstanding attempt to classify elements was made by the Russian chemist, Dmitriy Mendeleev. 2. Dmitriy Mendeleev made an outstanding attempt to classify elements.
II. 1. Mendeleev published his Periodic Table of Elements in 1869. 2. The Periodic Table of elements was published in 1869.
III. 1. A new commercial distillation process was developed by Dmitriy Mendeleev. 2. Dmitriy Mendeleev developed a new commercial distillation process.

IV. 1. Wilhelmy discovered the laws of chemical kinetics. 2. The laws of chemical kinetics were discovered by Wilhelmy.
V. 1. Willard Gibbs opened the door to the effective analysis of heterogeneous systems. 2. The effective analysis of heterogeneous systems was opened by Willard Gibbs.
VI. 1. E. O. Lawrence invented the cyclotron. 2. The cyclotron was invented by E. O. Lawrence.

Exercise XV. Insert the correct form of the verb given in brackets.

1. The early chemists (to organise) the elements according to convenience and practical use. 2. The chemists first (to group) elements as metals and non-metals. 3. As the number of known elements (to increase) and more (to learn) about them, things (to get) confusing. 4. Many interesting plans for grouping the elements (to propose) from time to time. 5. The first systems of classification of elements (to be) crude and (to base) on atomic masses.

Exercise XVI. a) Use the words «so» or «too» to indicate that another person or thing performs the same action the first person or thing does. Follow the model: 1 am 18, and you are too = lam 18, and so are you. She studies biology, and he does too = She studies biology, and so does he.

1. John studies at NYU, and Nick ... too. 2. I will be in New York next month, and so ... she. 3. He studied chemistry last year, and so ... they. 4. I must follow these rules, and you ... too. 5. We have a lot of friends here, and so ... they. 6. He is going to help us, and she ... too.

b) Use the words «neither» and «either» to indicate negative agreement. Follow the example: I don't know this man, and she doesn't either = I don't know this man, and neither does she.

1. She can't speak French well, and ... can he. 2. John does not pay much attention to sports, and Mary ... either. 3. My brother does not like sports, and neither ... I. 4. They didn't call us yesterday, and we ... either. 5. Mike won't finish his research next month, and neither ... Betty.

Exercise XVII. Rewrite the story below, using passive structures wherever it is possible.

In 1882 Lord Rayligh started to redetermine the density of oxygen and hydrogen and later extended the work to nitrogen, whose atomic weight is of fundamental importance in connection with the determination of the atomic weights of many elements. He used nitrogen prepared from the atmosphere by the elimination of the oxygen and of all other reactive gases, such as carbon dioxide and water vapour, and also nitrogen prepared by the decomposition of ammonia. To his astonishment, the atmospheric nitrogen was appreciably heavier than that prepared chemically. After many checks, he discussed the matter in 1894 with Ramsay, who investigated the nature of the atmospheric nitrogen by causing it to react with metals, such as magnesium, which combine with nitrogen. About one per cent of the gas would not react, and this proved to be a new gas. Ramsay named it argon, the «easy» gas. Following this discovery, Ramsay isolated four other gases having properties similar to argon — helium, neon, krypton, and xenon. It looked as if there were no place for them in the periodic table, but soon it was realised that they formed a new group of elements of zero valences unable to form compounds. Instead of casting doubt on classification, they extended and enhanced its validity.

Exercise XVIII. Restore the questions to the following statements.

1. The study of catalytic phenomena was systematically brought into the domain of chemical kinetics and investigated quantitatively. 2. At that time, the attention of chemists was largely directed to the discussion concerning the structure of organic compounds.

3. The isotope of hydrogen, which has an atomic weight of 2, was isolated by Harold Urey at Columbia University in 1931. 4. The electron theory of valence was worked out by G. Lewis in 1916. 5. In 1850 the progress of a chemical reaction was measured and the results expressed as a mathematical equation. 6. In 1849 hydrocarbons of the methane series were synthesised by E. Frankland. 7. The true nature of combustion was demonstrated by Lavoisier in 1772.

Exercise XIX. Translate the following sentences into English.

1. Різниця між атомами елементів була обумовлена відмінністю числа протонів та нейтронів у ядрі. 2. Маса атома майже повністю сконцентрована в ядрі. 3. Хімічні властивості різних елементів пояснювалися структурою атома. 4. Елементи класифікуються як метали та неметали на основі їх хімічних властивостей. 5. Хімічна активність металів та неметалів була зумовлена розмірами атомів та кількістю електронів на їх зовнішніх орбітах.

SCIENTIFIC COMMUNICATION

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

MEASUREMENT OF IONISATION ENERGY

The ionisation energy provides a basis for (розуміння) the periodicity of the chemistry of dements. (Завдяки) the stimulation of Bohr’s ideas, many systematic determinations of onisation energies were carried out between 1914 and 1920. The first determinations (були іроблені) by bombarding an atomic vapour with electrons whose kinetic energy was known 'точно). When the kinetic energy of bombarding electrons (зростала) to a certain critical value, iingly charged positive ions (виявлялися) electrically. These ions (виникали) from collisions between atoms and the bombarding electrons that were given just enough kinetic energy to cause he most weakly bound electron to be ejected from the atom.

Exercise XXI. Continue the Table indicating the uses of oxygen and nitrogen.

Exercise XXII. Write a descriptive essay about the uses of bromine.

Exercise XXIII. Read and translate the fragment of John Updike poem «The Dance of the Solids». Write out all the physical properties of metals described in it.

The metals, lustrous Monarchs of the Cave,
Are ductile and conductive and opaque Because each atom generously gave Its own electrons to a mutual stake,
A pool that acts as bond. The ions take The stacking shape of spheres, and slip and flow When pressed or dented; thusly metals make A better paper clip than a Window,
Are vulnerable to shear, and, heated, brightly glow.

Exercise XXIV. Use the words and phrases supplied below to make up extensive answers to the questions.

1. What is the major contribution of Mendeleev to the development of chemistry? (characteristic families of elements, the value of grouping, similar properties, key elements, to simplify the study of chemistry, to predict the properties, undiscovered elements). 2. What are the major contributions of Mosley to the development of chemistry? (characteristic number of protons, atomic nucleus, a basis for classification, increasing atomic number, regularly recurring properties, periodic functions, atomic numbers).

Exercise XXV. State and explain the following trends.
1. The effect of increasing atomic number on ionisation energy. 2. The effect of increasing atomic number on atomic radius.

Exercise XXVI. Define atomic number and discuss its significance in determining the properties of the elements.

Exercise XXVII. Compare sizes of atoms relative to sizes of their nuclei.

Exercise XVIII. Summarise the major advantages of the Periodic Table and identify its weakness.

Exercise XXIX. Say which of the statements is correct.

I. 1. Elements in a vertical column have similar properties. 2. Elements in vertical column have different properties.
II. 1. As the atomic number within a family increases, the atomic radius also increases. 2. As the atomic number within a family increases, the atomic radius decreases.
III. 1. As the atomic number within a family increases, the ionisation energy decreases. 2. As the atomic number within a family increases, the ionisation energy also increases.
IV. 1. Elements in a horizontal row show a decrease in metallic properties as we read from the left to the right. 2. Elements in a horizontal row show an increase in metallic properties as we read from the left to the right.
V. 1. As the atomic number increases within a period, the atomic radius tends to increase. 2. As the atomic number increases within a period, the atomic radius tends to decrease.
VI. 1. As the atomic number increases within a period, the ionisation energy decreases. 2. As the atomic number increases within a period, the ionisation energy increases.

Exercise XXX. Refer to halogen column in the Periodic Table. How many electrons must each halogen atom gain to have an electron population equal to that of an atom of the adjacent inert gas? What property does this population impart to each ion?

Exercise XXXI. Use the formulas for magnesium oxide, MgO, and magnesium chloride, $MgCl_b$ together with the Periodic Table to decide that magnesium ions have the same number of electrons as each of the following, except:

a) neon atoms, Ne;
b) sodium ions, Na;
c) fluorine ions, F";
d) oxide ions, 0_2;
e) calcium ions, Ca_2.

Exercise XXXII. In Group VII (the halogen family) state the following trend and cite the reason for each:

a) the effect of increasing atomic number on the atomic radius;
b) the effect of increasing atomic number on ionisation energy.

Exercise XXXIII. Transform short (encyclopaedia style) information given below into an extended description of radium. Then use the following chronological table to speak about the history of the element. Compare the tenses.

Radium — radioactive element, light metal, white with silvery lustre, density 6 g/cm^3, m. p. 700°C, active.

1898 — discovery of radium by the Curies.
1899—1901 — attempts to obtain radium salts.
1902 — preparation of pure radium chloride.
1903 — discovery of helium in radium emission.
1904—1906 — investigation of physiological effects of radium rays.
1910 — obtaining of pure metallic radium.

Exercise XXXIV. In his Nobel Lecture Pierre Curie compared the discovery of radium with the discovery of an explosive by Alfred Nobel. Why?

Exercise XXXVIII. Tell the story of the Periodic Law discovery. Follow the chronological pattern in your narration.

Supplementary Text

BACKGROUND OF THE HALOGEN FAMILY

Halogens are very reactive elements that exist under normal conditions as diatomic molecules with covalent bonds. These molecules are all coloured. Gaseous fluorine is pale yellow; gaseous chlorine is yellow-green; gaseous bromine is orange-red; and gaseous iodine is violet. The halogens are all toxic and dangerous substances. Fluorine, F_2, is the most hazardous. All fluorides must be handled carefully. A mixture of hydrogen and fluorine has been studied for possible use as a rocket fuel. A variety of useful compounds contain fluorine. Some communities add fluorides to their water supply to stop tooth decay. Compounds of fluorine with carbon and hydrogen, known as Freons and Teflons, have many uses. Freons are used as refrigerants. Teflons are resistant to corrosive chemicals.

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

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

Iodine is the most gentle member of the halogen family. It is found in ocean water and in certain kinds of seaweed. In small amounts iodine is essential to human life. It is added to common table salt. To the average person iodine is known in the form of the tincture, used as an antiseptic.

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

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

Exercise XXXV. Be ready to answer the following questions.

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

Exercise XXXVI. The author is primarily concerned with:

a) describing the discoveries of the elements;
b) describing the chemical properties of the elements;
c) describing the uses of the elements;
d) describing the position of the elements in the Periodic Table.

Exercise XXXVII. The passage suggests that we use chlorine in order to:

a) kill bacteria;
b) bleach clothing;
c) to manufacture anti-knock gasoline;
d) to stop tooth decay.

Exercise XXXVIII. *The discussion of fluorine in the passage suggests which of the following conclusions:*

a) fluorine is extremely dangerous to inhale;
b) fluorine compounds are used as sedatives;
c) fluorine is a very active compound;
d) fluorine is added to drinking water.

Exercise XXXIX. All of the following can be found in the author's discussion of the Halogen family except:

a) fluorine is a pale yellow gas;
b) compounds containing astatine are commercially useful;
c) chlorine is a gas of great importance;
d) bromine was discovered in 1826 by a French chemist named Balard;
e) the element of iodine is found in ocean water and in certain kinds of seaweed.

Exercise XL. Have fun and study the names of newly «discovered» elements. Add coinages of your own to the list.

Budweisium, Bs: has no taste or smell, is often indistinguishable from water.

Politicium, Pol: contains a great deal of gas, similar to radon in that it can reach lethal concentrations in the House.

Congress, Cg: atomic number 525, can never be found in a solution.
Canadium, Cn: similar to Americium, but a little denser, much more rigid, often called Boron.

Exercise XLI. Translate the following text. In pairs, ask and answer questions about D. Mendeleev's life and work.

DMITRIY MENDELEEV
(1834—1907)

Element 101 is named Mendelevium in honour of the great Russian chemist Dmitriy Mendeleev.

D. Mendeleev was bom in Tobolsk, where his grandfather published the first newspaper in Siberia and his father was the high school principal. Dmitriy received his early education from a political exile, but when his father died, his mother travelled to the west in search for better educational opportunities for Dmitriy.

At the University of St. Petersburg he distinguished himself in science and mathematics and earned the doctorate with a thesis on a subject that remains of current interest, «The Union of Alcohol and Water». Subsequent studies in France and Germany permitted him to attend in 1858 Karlsruhe (Germany) conference at which Avogadro's Hypothesis was heatedly debated. Later, he visited the oil fields of Pennsylvania to see the first oil well. On his return to Russia, he developed a new commercial distillation process.

He became a professor of chemistry at St. Petersburg, when only 32. Searching for regularities, he arranged the elements by their properties. This organisation led him to propose the Periodic Table and use it to predict the existence and properties of a number of additional elements.

When some of those that were foretold in 1869 were actually discovered a few years later, Mendeleev was hailed as a prophet.

This inspiring teacher and tireless experimenter was so deeply concerned over social issues that he resigned his professorship rather than obeyed an order to cease interfering with affairs of the government. He made enemies by supporting liberal movements and even defied the Czar's wishes by refusing to cut his hair. Nevertheless, he won the appointment as Director of the Bureau of Weights and Measures.

When Mendeleev first published his chart, there were 63 elements known. One year after his death, there were 86. The rapidity of this increase was made possible by the most important generalisation of chemistry, the Periodic Table.

Mini-Test

1. Write down 10 keywords to the text.
2. When was the Periodic Table of Elements published?
3. Give definitions of:
   a) compound;
   b) element.
4. Give meanings of the following words:
   a) define, definite, definition;
   b) observe, observation, observer;
   c) period, periodic, periodicity.
5. Insert the correct form of the verb given in brackets.
   The discovery of the X-rays (to follow) by the discovery of radioactivity.
   Plutonium (to make) in a cyclotron.
6. Say which of the statements is correct:
   1) As the atomic number within a family increases, the ionisation energy decreases.
   2) As the atomic number within a family increases, the ionisation energy also increases.

Self-Test Rating

Task number	Rating
1	1000
2	100
3	**600**
4	**900**
5	**600**
6	**600**

Unit Ten

Exercise I. Pronounce the following words:

procedure	burner
observation	beaker
interpretation	flask
inference	funnel
equipment	jar
glassware	bottle
device	mortar
apparatus	crucible
thermometer	explosively
calourimeter	researcher
polarimeter	analyser

Exercise II. Pronounce the following word combinations:

reliable results
accurate information
practising scientist
hydrochloric acid
experimental set-up
dilute acid
delivery tube
calourimetric analysis

Text A

LABORATORY EXPERIMENTS

Keywords: *procedure, observation, interpretation, inference, hypothesis, experimentation, investigation, analysis, test, equipment, glassware, device, apparatus, experimental set-up.*

Work of scientists includes the procedures of observation, interpretation, inference, hypothesis, prediction and experimentation. There is no magic formula for solving a problem in the laboratory, but there do exist some patterns which are characteristic of an experimental investigation. Any investigation must be planned and repeated, perhaps hundreds of times. The conditions of the experiment must be controlled for obtaining reliable results. The results must be tested more than once in order to obtain accurate information. Each time the cycle begins again: observation, interpretation, inference, construction of a new hypothesis and more testing...

Students do not discover new knowledge every time they come to a laboratory, but here they acquire skills of a practising scientist.

Now we are in the laboratory of inorganic chemistry with its long lab benches, burners and ventilating hoods. We see a lot of various glassware here: beakers, test tubes, flasks, funnels, retorts, jars, bottles, mortars, crucibles, evaporating dishes, etc.

This time students are going to obtain hydrogen in the reaction of magnesium with hydrochloric acid. During the experiment the students are pouring dilute hydrochloric acid in the jar through the thistle tube. Then small pieces of magnesium are being put in the acid and bubbling begins. Hydrogen is being formed and is passing through the delivery tube to the inverted bottle. The bottle is filled with water because hydrogen combines explosively with oxygen in the air. So students must use extreme caution when experimenting with it.

Now we are leaving the laboratory of inorganic chemistry and are going to the modem laboratory of analytical chemistry. Here we see a researcher who is analysing various reagents (automatic testing of 60 samples at a time). The analyst is taking reagents and calibrating agents from the shelves and is putting them in the apparatus. In 30 minutes the first results of calourimetric analysis will be displayed on the computer screen. If necessary, data obtained will be printed out by an automatic printer.

Biological sciences experienced a real break-through in the detection and identification of microbial hazards in the environment. Novel devices can be used wherever there is an access to electricity. They do not need water or plumbing. Microbial contamination results can now be obtained anywhere in the laboratory within 90 minutes of sampling. The speed of laser scanning in such instruments allows samples to be loaded every three minutes. In addition to fungi and bacteria, even spores, stressed and fastidious cells can be detected and counted in less than 90 minutes. The way from sampling to results is simple: membrane filtration, cell labeling and laser scanning. Environmental test kit for on-site analysis of water and wastewater, for instance, includes incubator, filtration set for bacteria analysis, electronic photometer, meters for pH, conductivity and temperature measurements.

Special portable weather stations were developed for up-to-the-minute environmental weather control. The parameters, such as wind, temperature, humidity, air pressure, radiation and so on, are monitored at real-time intervals and the results are converted into a voice message. Such stations fmd wide application in farming, firefighting, sports events, where accurate weather data are needed every minute.

Power of our senses can be greatly increased by means of various laboratory equipment: analytical balances, thermometers, colorimeters, barometers, spectrometers, electron microscopes, polarimeters, refractometers, X-ray devices, computers, etc.

Laboratory experimentation provides the foundation upon which our understanding of nature can be built.

VOCABULARY AND COMPREHENSION

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

1. What procedures does a work of a scientist include? 2. What stages are characteristic of any experimental investigation? 3. What is the aim of students work in a laboratory? 4. What can we see in the laboratory of inorganic chemistry? 5. What are students going to do there? 6. What reaction produces hydrogen? 7. What are students doing at the moment? 8. How do they know that hydrogen is being formed? 9. Whom do we see in the analytical laboratory? 10. What is the analyst doing? 11. How many samples can be automatically analysed at one time?

11. What equipment is used in geochemical laboratories? 12. How fast do novel weather stations work? 13. How does a portable on-site test kit for waterwastes work?

Exercise IV. Divide the text into sense parts and give headings to each of them.

Exercise V. Find the paragraph where the laboratory of inorganic chemistry is described.

Exercise VL Write out the topic sentences of the text «Laboratory Experiment».

Exercise VII. Write two lists of terms: one naming pieces of chemical glassware, the other — instruments and devices.

Exercise VIII. Remember the definitions of some pieces of chemical glassware used in experiments.

Burette — graduated glass tube used to deliver variable volumes of liquid with a stopcock to control the liquid flow.
Pipette — graduated or calibrated tube which may have a centre reservoir to transfer known volumes of liquids.
Retort — vessel for distillation or decomposition of a substance.
Evaporating dish — shallow vessel for evaporation.
Tube — a long cylindrical body with a hollow centre used especially to convey fluid.

Exercise IX. Fill in the blanks with appropriate terms.

Small narrow necked bottle — ...
Y-shaped vessel through which liquid or powder can be poured into a narrow-mouthed container — . . .
A bottle for measuring quantities of liquids — ...

Exercise X. Give English equivalents of the following word combinations.

a) атомна вага елемента, атомна концепція, електронна структура, хімічна поведінка, дозволений енергетичний рівень, променева енергія.

b) втрачати енергію, рухатися навколо ядра, випромінювати енергію, пояснювати хімічну поведінку, визначати атомну вагу, займати енергетичний рівень.

Exercise XI. In each of the following pairs find the item that best completes the comparison.

1. Funnel is to glassware as:
   a) spectrophotometer is to apparatus;
   b) method is to technique;
   c) analysis is to synthesis.
2. Cobalt is to carbon as:
   a) barium is to iodine;
   b) distillation is to crystallisation;
   c) zinc is to silicon.
   d)

Exercise XII. Open the brackets and choose the correct word or word combination to make the sentence true.

1. An experiment must be planned and repeated (one time, hundreds of times). 2. The results must be tested in order to obtain (accurate, important) results. 3. An investigation cycle begins with (testing, observation). 4. Hydrogen is obtained in the reaction of zinc with (acid, base). 5. Hydrogen is collected (over water, in the air) not to explode. 6. Power of our senses can be greatly increased by (various instruments, medical drugs).

Exercise XIII. Name the procedures which physicists/chemists use in experimentation.

Exercise XIV. Decide which word best fits the meaning of the sentence.

1. A work of scientists includes the procedures of observation, interpretation,_____ , and experimentation.
   hypothesis or prediction
2. There are some _____ which are characteristic of an experimental investigation.
   ways or patterns
3. Students skills of practising scientists in a laboratory.
   receive or acquire
4. An automatic analyser can test sixty _____ at a time.
   substances or samples
5. In the reaction with metals hydrochloric acid must be_____ .
   dilute or weak.

WORD-BUILDING

Exercise XV. Give verbs, which define the actions taking place in the following procedures and processes (section A). Then use the words from section A as modifiers of the nouns from section B.

A. Observation, experimentation, prediction, investigation, interpretation, burning, construction.
B. Methods, results, accuracy, team, temperature, material, technique.

Exercise XVI. Use the prefix de- to form verbs. Translate them into Ukrainian. What meaning has the prefix?

Example: **to gas - to degas.**

To generate, to grease, to humidify, to hydrate, to hydrogenate, to locate, to oxidise, to protonate, to salt, to solubilise.

Exercise XVII. Find in the text the names of analytical instruments. What Greek or Latin elements were used to build these terms?

Exercise XVIII. Write down names of acids you know. What suffix is used to form them?

Text B

MODERN BIOCHEMISTRY AND ORGANIC CHEMISTRY

Modem organic chemists are still exploring that area which intrigued the first organic chemists — the chemistry of living systems. Numerous investigations throughout the nineteenth and twentieth centuries established the fact that most physiologically active compounds are organic. The enormous chemical complexity of living systems frustrated early efforts to understand the molecular basis of biological function. But we began to discover what happened to molecules when they were digested, for instance, it seemed more and more likely that chemical reactions which take place in cells are similar to ones well known in the laboratory. The same principles are involved in test tube organic chemistry and in the reactions of molecules in a biological system. This understanding stimulated the study of biochemistry because it meant that the chemical insight gained by pure organic chemists could serve as a guide to those interested in physiological systems.

While many chemists seek to apply organic chemistry to the study of living systems, this is by no means true of all chemists. The chemist may be a specialist in one or more of these areas, or he or she may use all the different techniques in solving a particular problem.

GRAMMAR STRUCTURE

Present, Past and Future Continuous (Progressive)
Tenses in Description (processes and procedures)

	Personal Pronoun	**Present Continuous**	**Past Continuous**	**Future Continuous**
Active	**I**	**Am**	**Was**	**Shall be**
	You	**Are**	**Were**	**Will be**
	He	**Is**	**Was**	**Will be**
	She	**Is *speaking***	**Was *speaking***	**Will be *speaking***
	It	**Is**	**Was**	**Will be**
	We	**Are**	**Were**	**Shall be**
	They	**Are**	**Were**	**Will be**

Present Continuous Passive	**am, is, are being studied**
Past Continuous Passive	**was, were being studied**

Note: continuous (progressive) tenses are not typical for scientific English. The Present Continuous
Tense is more frequently used than past or future varieties. It can be encountered in the description of processes, procedures or experiments as if being held before our eyes.

Exercise XIX. Below are some sentences in the Present Simple Tense. Rewrite each one in the Present Continuous. Insert time signals: now, at the moment, at present, at the present time, right now.

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

Exercise XX. Open the brackets and choose the correct form of the verb.

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

Exercise XXI. *In the questions fill in the correct form of to be or to do.*

A. 1. ... students observing the change of solution colour? 2. ... students participating in the scientific conference held at your institute? 3. ... an analyst study properties of solutions in this experiment? 4.... the researcher examining sandwich compounds now?

B. 1. Now we are in the geochemistry lab,... we? 2. We see various microscopes and X-ray devices, ... we? 3. Researchers are going to study composition of some minerals, ... they? 4. They are setting up an apparatus to study calcites,... they?

C. 1.Students do not discover new knowledge every time they come to laboratory, ... they? 2. We are not going to study the pyrite sample today, ... we? 3. The analyst is not measuring refractive index of minerals at the moment, ... he? 4. He does not know how to use this new device,... he?

Exercise XXII. *Compare the sentences. State who is definitely at a PC keyboard right now.*

Pete uses IBM PC to study structures of molecules.

David is using IBM PC to study structures of molecules.

Geochemists and mineralogists widely use spectrometric software in their analyses. A mineralogist is modeling hardness and cleavage characteristics of synthesised mineral.

Exercise XXIII. Insert the past, present or future tense forms of the verb according to the meaning.

1. When we came to the library students ... preparing for the seminar. 2.1... working in the library from 3 to 6 p. m. tomorrow. 3.1 ... going to the library right now. 4. They ... discussing a plan of their experiment at that time yesterday. 5. They ... going to speak about new biologically active compounds at the conference at the end of the week.

SCIENTIFIC COMMUNICATION

Exercise XXIV. Transform an instructive passage given below into a description of the experiment that you are carrying out right now.

1. Calibrate the pH meter by washing the electrode thoroughly by deionised water, and dipping it into a standard buffer solution and adjusting needle on meter.
2. Set up the apparatus as shown, with 50 cm^3 of molar hydrochloric acid in the beaker and molar sodium hydroxide in the burette. Ensure that the tip of the electrode is completely immersed in the solution and that the stirring is efficient.

N. B. The electrode is very delicate and must be held in a clamp — not used as an additional stirrer.

3. Read the pH of the original acid and then proceed with the titration, reading the pH of the solution when the needle settles after each addition of alkali — see results table.

Exercise XXV. Write about the above mentioned experiment as a routine analysis. Remember: routine, habitual actions are expressed by the Simple Tenses.

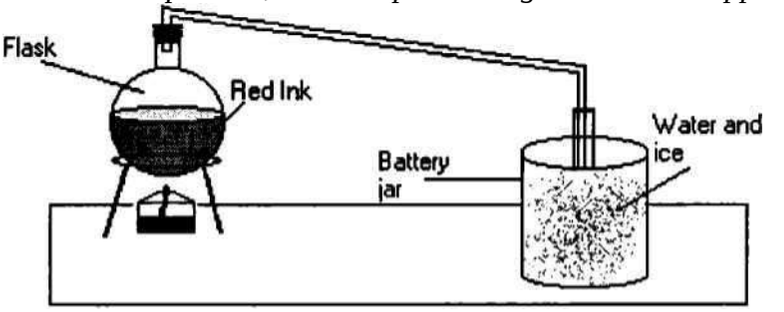
1. Instruments are important because they make the difference between qualitative and quantitative observations.
2. Quantitative information tells us how much, how fast, how large, how hot and so on.
3. Microscopes are used to see particles, which are too small for an unaided eye to detect.
4. A magnifying glass is also useful in the observation of small samples.

Exercise XXVII. Rearrange the mixed up sentences to simulate the talk between students and a teacher at a seminar. Identify the speaker for each sentence.

1. Today we are going to determine the relative molecular mass of an organic compound by Beckmann's depression of freezing point method. 2. Are we going to use a mechanic stirrer in the experiment? 3. I am setting up the apparatus for the determination. The boiling tube is suspending, it must be surrounded by ice water. 4. What must we use to melt ethanoic acid? 5. So, just use a glass stirrer. 6. Try the heater fan, please. 7. 25 cm^3 of glacial ethanoic acid are being put into the tube and stirred energetically. Look, all cooling crystals are appearing on the walls. Start recording t° at 0.5 min intervals. Plot a cooling curve. 8. I don't quite understand the difference between depression and cryoscopic constant. 9. No difference at all. They both define a constant amount by which a freezing point is depressed.

Exercise XXVIII. Look at the list of glassware in exercise XXXVII. In the form of questions and answers speak on the uses of chemical glassware and devices.

Exercise XXIX. Describe the process, which is proceeding in the below apparatus.



Exercise XXX. Read the fragment of the poem «A Mineral» written by the famous American mineralogist Cornelius S. Hurlbut Jr. What do you think about the competition between Nature and the chemists producing artificial materials?

Each year using new machines
And with new devices
We make our knowledge more complete,
And data more precise.
But for all these modem methods We cannot yet compete With the world of natural beauty That lies

beneath our feet.

До XVII сторіччя експериментальні методи не були поширені у науковій практиці. Вчені ще за часів Арістотеля більше вірили в індуктивне мислення, ніж у експеримент. Основні принципи експериментальної науки були викладені англійським філософом Ф. Беконом (1561—1626) у його знаменитих книгах «The Advancement of Learning» (1605) та «Novum Organum» (1620). Сьогодні експериментальний підхід у науці і навіть у побуті — звичайна річ. Історія Дж. де Гевезі, лауреата Нобелівської премії 1943 року, добре це ілюструє. Одного разу, живучи у невеличкому готелі, він почав підозрювати, що йому на сніданок дають вчорашню їжу. Застосувавши ізотопи, Гевезі впевнився, що це дійсно так. Результат — він негайно виїхав із готелю.

Exercise XXXI. Discuss the text given below.

COMMUNICATION

The most brilliant experiment ever performed would be of little value if no one ever heard about it. Therefore, communication is of utmost importance in science. When a scientist feels his work as precise and as complete as he can make it, he publishes the results of his experimentation. This has several benefits. It allows other scientists to try to duplicate his work and either confirm or dispute his conclusions. If his findings are confirmed by others, confidence in his hypothesis grows and scientific knowledge increases. If his hypothesis is found to be untrue, then other investigators do not have to spend time working on it and scientific knowledge is again increased. It is just as important to learn, through testing, that an idea is false as to find that it is probably true. The scientist seeks to learn the truth as much as possible; he is willing to reject ideas when the evidence shows that his idea is false.

Many of the laboratory activities in which you will engage will not be experiments in the sense that you will discover new knowledge, although quite often these discoveries will be new to you. This will enable you to experience a sense of exhilaration and accomplishment yourself. It is most important that you acquire the procedures of the practising scientist. You are encouraged to exercise your imagination, to utilise all your senses, to become a good observer, and to gain skill in making inferences and formulating and testing hypothesis.

You are expected to keep complete and accurate records of your laboratory experiments and to report your findings in the accepted manner. You will be given the opportunity to plan experiments to test hypothesis which you yourself propose. To do so means that you must acquire a new vocabulary, develop skill in making precise measurements and become familiar with problem-solving techniques. This can be the most rewarding part of your study of chemistry, for you will be engaging in the procedures of the scientist.

The language of communication differs from that of description. The place of the Present Indefinite and the Present Continuous will be occupied by the Present Perfect, Past and Future Indefinite Tenses. You will master these scientific English varieties in the next Units.

Make a list of the keywords of the above text. Does it supply information for answering the following questions?

1. What is scientific communication? 2. What is the aim of scientific publications? 3. Why do some hypotheses turn out to be wrong? 4. Why is it useful to learn if a hypothesis is true or false?

Does the text suggest the following conclusions?

1. A science student must learn to be a good observer;
2. Ability to observe and communicate can be sharpened;

3. Complete and accurate records of laboratory experiments are very important for a science student.

Exercise XXXIII. Read and discuss the following text. What other non-invasive

ION BEAM ANALYSIS IN ART AND ARCHAEOLOGY

The application of analytical techniques initially developed in the field of material science to art or archaeological objects gives the historian and the archaeologist quantitative information. This helps them understand the way of life in the cultures they are studying, or the technical and intellectual know-how of the artists or craftsmen of the period under consideration. In the world of museums, this knowledge is also needed for preparing and carrying out essential restorations, and for assessing the authenticity of artefacts and paintings. The degradation of monuments and outdoor statues is well known, but all artefacts, even those in exhibits or storage rooms, are subject to degradation. The phenomena must be studied to understand their cause and their kinetics, and to find out ways to slow them down or to prevent them from taking place.

All these objectives are common to the very large community of those who practise what is called today «archaeometry» or more general «application of sciences to art». Much of this work is based on elemental analysis, namely determining the concentration of elements present in an object. Until the 1960s, only chemical techniques were available for analysing composition. Since then, many other methods based on physical principles have been developed. They include microanalysis using electron beam microscopes and microprobes and approaches based on various types of particle and photon spectrometres. This interest led to construction of major accelerator- based facilities devoted to archaeometry such as the AGLAE accelerator at the Louvre.

Exercise XXXIV. Humour for biologists: have fun!

As we took notes, our teacher of anatomy laboured through a lecture on the way nerve cells transmit impulses. «Who will tell me how the cells communicate with one another?», he asked, expecting someone to explain neurotransmission. After a few muffled whispers one student spoke up: «With cellular phones?»

Much we know about man is derived from the study of sweet peas and a species of vinegar fly.

Exercise XXXV. Humour for geochemists: have fun! No kidding, the song gives us a vivid portrait of a geochemist and methods of research he prefers. Can we call geochemists romantic-minded? Why? Do you agree with the image of the geochemist portrayed here?

ON GEOCHEM ALONE I STAND
By Brenna Lorentz (www.heptune/geosong.html)

My theory's built on nothing less Than
geochem and righteousness No rocks
or strata have I seen,
On isotopes alone I stand.
All other ground is sinking sand,
All other ground is sinking sand.
I do my field work with ease
Collecting samples where I please —
I only look for samples where There is
a road to take me there.
For trees and bogs I cannot stand

I will not map on sinking sand,
I will not map on sinking sand.
There is nothing so doth please my heart As
data plotted on a chart,
On graphs and figures I propound,
My theory's brilliant and profound.
Phase diagrams I understand All other
ground is sinking sand,
All other ground is sinking sand.
Tectonicists may laugh at me And scorn my
geochemistry,
My theories are all safe and sound —
The source rocks hidden underground.
My theories on the mantle stand.
Disprove them if you think you can!
Disprove them if you think you can!

Exercise XXXVI. Come to know some rules of the telephone call etiquette.

Communicating by phone is more frequent today than ever before. To be effective at this business necessity, pay attention to some tips given below. Make them a part of your communication skill package.

1. Make your appointments for important calls just like you do that for meetings.
2. Make a list of important points to discuss beforehand.
3. Return all calls within the same day business hours.
4. If you receive visitors while being on the phone, motion them to take seats without interrupting your conversation.
5. Before putting someone on hold, always ask him, «May I put you on hold?» Never do this twice during one call.
6. Say «good-bye» and wait for the reply before hanging up.

Supplementary text

MICROORGANISMS IN THE ENVIRONMENT: PROBLEMS, DETECTION AND CONTROL

Increasing concern is being voiced about the presence of disease-causing (pathogenic) microorganisms in the environment. Today public debates possible risks associated with waste materials and biotechnology plants.

Unlike chemical contamination, where a large number of the contaminants are not regarded as naturally occurring except those that have been genetically manipulated, all microorganisms have niches in the environment to which they adapted.

When considering the necessity for analysis for a specific pathogen, a number of factors need to be considered. These include consideration of environmental niche of the organism, that is, does it survive in the matrix under consideration and if so, for how long. The potential routes of infection need to be considered: ingestion, inhalation, or skin contact and the infectious dose by each route, and whether human contact with that environment can result in disease.

In general, the majority of bacterial pathogens are detected by culture techniques. These depend on the use of growth media, which are, in general, specifically prepared to promote only the growth of the organism of interest. The identity of the organism can be further confirmed by analysis, such as detection of characteristic biochemical response or by the use of specific antibodies.

A considerable drawback with these methods is the time taken to obtain a result. Analysis of bacteria from environmental samples can typically take 2-3 days, however some take considerably longer, for example Bacillus anthracis, causative agent of anthrax, takes 5 days.

A number of more rapid techniques were developed and are increasingly used for environmental analysis. These include the use of specific antibodies raised against the organism, developed into a kit form, whereby reaction with the organism with these antibodies, followed by washing technique, followed by suitable visualisation (eg colour development) can allow sensitive detection of the target.

The use of nucleic acid-based technologies can give rapid analysis. In particular, the Polymerase Chain Reaction has been developed for some organisms. PCR relies on the amplification and detection of specific segments of the organism's DNA.

Study the steps to be taken when considering microbial contamination:

1. Determine potential presence of microbial contaminants (historical records).
2. Evaluate results. Assess risks.
3. Design sampling regime, the most appropriate methods and sample points.
4. Evaluate results. Assess risks.
5. Design and implement control and monitoring measures, e.g. disinfection.

Be aware of the safety rules in the laboratory:

1. Perform laboratory work only when your teacher or a lab assistant is present. Unsupervised lab work is not allowed.
2. Read, think and plan your lab work before starting.
3. Know the location and use of safety equipment in your laboratory: safety shower, eye wash, first-aid kit, fire extinguisher and blanket.
4. Wear a lab coat or apron, protective glasses or goggles. Tie back loose hair.
5. Clear your benchtop of all unnecessary material: books, bags, etc., before starting.
6. Check chemical labels to make sure you have the right chemical.
7. Avoid unnecessary movement and talk in the laboratory.

Now it's your turn to continue the list. Think of some other rules of laboratory conduct and note them down. You may change the numbering and arrange the full list of the safety rules in the order of their importance.

Mini-Test

1. Write ten keywords of the text.
2. Write a list of chemical apparatus and glassware (10 pieces).
3. Give English equivalents of the following word combinations.

   Процес спостереження та інтерпретації, отримувати достовірні результати, працювати з експериментальною установкою, автоматична обробка зразків.
4. Detect the wrong word in the sentence.
   a) The experiments are been conducted in our laboratory.
   b) Now chemists is searching for new biologically active compounds.
   c) Our dean is lecturing from two to four o'clock yesterday.
   d) Our group will be discussed the results of the test at 2 p. m. on Monday.
5. Change the following sentences into negative.
   a) Electron structure is being revealed by an optical microscope.
   b) Chemists are dissolving substances in crucibles.
   c) Unstable solutions are usually heated energetically.
6. *Now; at the present moment; right now are the signals of what tense?*
7. The receipt of a chewing gum, please.

Unit eleven

Exercise I. Pronounce the following word combinations:

cobalt nitrate solution
colour identification
charcoal block
oxidising flame
metallic oxide
coloured compound

Text A

PRINCIPLES OF QUALITATIVE ANALYSIS AND ENVIRONMENTAL MONITORING

Keywords: *qualitative analysis, procedure, determine, unknown material, identification, careful record, quantity, characteristic test, reagent.*

Qualitative analysis is a procedure for determining what substances are present in an unknown material. Differences in solubility, the principles of ionic theory, hydrolysis, common ion, buffers, and acid-base reactions become most important when you deal with a water solution. Knowledge of atomic structure and equation writing are all involved and are tools as essential to successful laboratory work as the test tube.

In qualitative analysis a careful record of reagents, which have been obtained, difficulties you have encountered, and conflicting evidence are vital to successful identification of unknowns and to effective communication of results. Your notebook should be permanently bound; no pages should be removed and no entry deleted. The date of your work, the code number of the unknown, the procedure which you have done, and all confirmatory tests are important. Your records must be as honest as possible. Your notebook is good if another person skilled in analysis can take it, read it, and, by following the procedures indicated, duplicate your work and arrive at the same conclusions.

Cobalt nitrate solution can be used for colour identification of certain metals in your experimental work. Some quantity of the unknown solution was placed on a charcoal block and heated strongly with the oxidising flame of a blowpipe. This formed an oxide of the metal. Then a few drops of cobalt nitrate solutions were placed on the metallic oxide, and again the mixture was strongly heated with the blowpipe. The cobalt nitrate decomposed into cobalt oxide, which combined with the metallic oxide previously formed on the charcoal. Aluminium, zinc, and magnesium gave characteristic coloured compound in this test.

In recent years analytical chemistry and qualitative analysis have become closely connected with the industrial control and monitoring of the environment. The role of skilled and conscious chemical ecologists and analysts in nature protection is of primary importance. There are a lot of hazards in the surrounding world and many substances and actions can cause injury, disease, economic loss or environmental damage. Among these are physical hazards, e.g. ionising radiation, noise, earthquakes, storms, fires, etc, chemical hazards, harmful chemicals in air, water, soil and food, biological hazards, such as bacteria and viruses, and finally cultural hazards from working and living conditions.

People are exposed to many toxic chemicals and disease-causing factors throughout their lives. Determining toxicity levels of chemicals and harmful effects of biological organisms is vitally important.

This can be achieved by tests on live lab animal's (in vivo) cells, bacteria and tissue cultures, as well as by various chemical analyses, analytical tests in particular.

Safe water supplies, public sanitation, adequate food and many other spheres of human life rely on accurate risk analysis, continuous monitoring of the environment with timely application of analytical techniques.

VOCABULARY AND COMPREHENSION

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

1. What is qualitative analysis?
2. What becomes most important in qualitative analysis when you deal with a water solution?
3. What is vital to successful identification of unknowns and to effective communication of results in qualitative analysis?
4. How should your notebook look like?
5. What are the errors in qualitative analysis caused by?
6. To what hazards are people exposed throughout their lives?
7. How can toxic substances be detected in the environment?

Exercise III. In what line of the text do you read:

1. That qualitative analysis is a procedure for determining what substances are present in an unknown material. 2. That knowledge of atomic structure and equation writing are all involved and tools as essential to successful laboratory work as the text tube. 3. That your notebook should be permanently bound; no pages should be removed and no entry deleted. 4. That your records must be as honest as possible. 5. That most of the errors made in qualitative analysis have been caused by carelessness.

Exercise IV. From the following choose the word which is opposite in meaning to the following.

- quantitative, opposite, external, inactive, rapid.
- unable, known, unbelievable, complete, formed, essential, insufficient.
- imply, request, invest, include, exclude.
- negligence, care, affection, accomplishment, combination, gratitude.
- faithful, false, true, doubtful, active, improvable.
- lasting, temporary, persistent, moderate, invisible, irritable.

Exercise V. Choose the word that best keeps the meaning of the original sentence.

1. Qualitative analysis is a procedure for *determining* what substances are present in an unknown material.
   a) discussing
   b) considering
   c) defining
   d) studying
2. Knowledge of atomic structure and equation writing are all involved and are tools as *essential* to successful laboratory work as the test tube.
   a) apt

b) important
c) necessary
d) vital

4. Your notebook should be *permanently* bound.
a) convincingly
b) fully
c) perpetually
d) deliberately

5. Your records should be as *honest* as possible.
a) pure
b) faithful
c) careful
d) false

6. Cobalt nitrate solution has already been used for colour identification of *certain* metals.
a) unknown
b) uncertain
c) real
d) definite

Exercise VI. Say which of the statements is correct.

I. 1. Qualitative analysis is a procedure for determining what substances are present in an unknown material. 2. Quantitative analysis is a procedure for determining what substances are present in an unknown material.

II. 1. Differences in solubility, the principles of ionic theory, hydrolysis, the common ion, buffers, and acid-base reactions become most important in qualitative analysis, when you deal with a water solution. 2. Differences in solubility, the principles of ionic theory, hydrolysis, the common ion, buffers, and acid-base reactions become most important in qualitative analysis of substances in gas phase.

III. 1. Your notebook is good if another person skilled in chemistry can take it, read it, and, by following the procedures indicated duplicate your work and arrive at the same conclusions.

1. Your notebook is good if another person skilled in chemistry can take it, read it, and by following the procedures indicated, duplicate your work and arrive at different conclusions.

IV. 1. Most of the errors made in qualitative analysis are caused by carelessness. 2. Most of the errors made in qualitative analysis are caused by careful experimental work.

WORD-BUILDING

Exercise VII. Use the following prefixes of negation to make opposites of the following words:

un-: known, important, used, familiar, stable; in-: effective, definite, correct, significant.

Exercise VIII. Give nouns corresponding to the following verbs. Construct a «word-flower» for «to identify» and «to mix».

To determine, to solve, to use, to identify, to communicate, to indicate, to conclude, to mix, to decompose, to combine.

Exercise IX. Form the adjectives from the nouns with the suffix «-ive».

Quantity, quality, effect, communication, confirmation, indication, conclusion, oxidation.

Exercise X. Match the adjectives of column A and the nouns of column B to make terminology phrases.

A	**B**
Qualitative	Tests
Unknown	Theory
Ionic	Material
Atomic	Work
Successful	Structure
Effective	Analysis
Confirmatory	Communication

GRAMMAR STRUCTURE

The Perfect Tenses in Scientific English

Present, Past and Future Perfect Tenses (Active and Passive)

	Pronoun	**PresentPerfect**	**PastPerfect**	**FuturePerfect**
Active	**I**	**Have**	**Had**	**Shall**
	You	**Have**	**Had**	**Will**
	He	**Has**	**Had**	**Will**
	She	**Has + studied**	**Had + studied**	**Will + have + studied**
	It	**Has**	**Had**	**Will**
	We	**Have**	**Had**	**Shall**
	They	**Have**	**Had**	**Will**
Passive	**I**	**Have**	**Had**	**Shall**
	You	**Have**	**Had**	**Will**
	He	**Has**	**Had**	**Will**
	She	**Has + been + studied**	**Had+ been + studied**	**Will + have + been + studied**
	It	**Has**	**Had**	**Will**
	We	**Have**	**Had**	**Shall**
	They	**Have**	**Had**	**Will**

Note: *the Present Perfect Tense with its meaning of the action which has happened at some unspecified time in the past or began in the past and has continued to the present is very popular in scientific English, especially when one writes reports, abstracts, summaries, etc. about the accomplished work and results obtained The above-mentioned «small» genres of scientific communication are characterised by a brief, repor-style manner of writing. (No dates, please).*

Exercise XI. Decide whether the Past Simple or the Present Perfect best completes each sentence.

1. We (have studied, studied) solubility of these solids. 2. At that time researchers (paid, have paid) much attention to solubility studies. 3. The Curies (have discovered, discovered) radium in 1896. 4. The results of the experiment (were discussed, have been discussed). 5. Analysts usually (performed, have performed) quantitative analysis before qualitative one. 6. This problem (has been solved, was solved) two years ago.

Exercise XII. Fill in the correct form of the auxiliary verb in the blank space.

1. They have already selected necessary solvents.	She_____ already selected necessary solvents.
2. They have just finished our experiment.	He _____ just finished his experiment.
3. She has never worked with noble gases.	He _____ never worked with noble gases.
4. When a laboratory assistant came all students had cleaned their benches.	When students came to a laboratory she _____ already been there.
5. We shall have finished all our calculations by May.	They _____ finished all their calculations by May.

Exercise XIII. Drop a doer of an action as unimportant and change the following sentences into passive.

1. Scientists of an analytical laboratory have performed qualitative determination of some new compounds. 2. They have obtained interesting results. 3. The researchers have modelled their experiment with the help of a personal computer. 4. They have often used PCs in molecular structure calculations. 5. The scientists have sent the article with the results of the experiment to the Journal of Analytical Chemistry.

Note: if you performed the task in a proper way, you obtained a brief report on the experiment made in the analytical laboratory.

Exercise XIV. Now write a report on your latest practical work in the biological / physical / chemical laboratory.

Exercise XV. Restore questions to the following answers.

Yes, I have. I've worked with many analytical instruments.
No, I haven't. I have just prepared a standard solution.
No, I haven't. Recently I haven't studied electrolytes.

Exercise XVI. Rewrite the following instructive text in the form of a report about your experiment; use the Present Perfect Tense (passive) in the procedural part.

PREPARATION OF TETRAGONAL COPPER (II) SULPHATE

This is an example of preparation of complex cmpds, i.e. compounds containing complex ions.

The ion here is one of a large number with copper-nitrogen bonds. This ion is readily formed and the complex salt is easily precipitated with ethanol.

1. Dissolve 5 g of copper (II) sulphate pentahydrate in 20 cm^3 of water in a 250 cm^3 beaker. 2. Add 2 mol dm^{-3} ammonia solution, slowly with shaking, until the blue precipitate which first forms is completely redissolved to give a deep blue solution. 3. Add 30 cm^3 of ethanol and leave in the refrigerator. 4. Filter off the crystals using a Buchner funnel and suction pump. 5. Wash the crystals with ethanol containing a drop of concentrated ammonia solution. 6. Dry at room temperature. 7. Weigh the crystals and work out the yield.

Text B

LAKES, OCEANS AND SEAS

Lakes are areas of water surrounded by land. They occur where water collects in hollows in the Earth' surface, or behind natural or man-made barriers.

Lakes don't last forever. The water may cut through the barrier, so the lake drains away. Sooner or later most lakes fill up with sand and mud. As a river enters a lake, the water flows slower and drops its load of sediment. Plants grow in the sediment, trapping more sand and mud.

Lakes also disappear if more water flows out of them or evaporates than the rivers bring in. When a desert lake evaporates, the dissolved salts and sediments are left behind and gradually fill up the lake, which becomes very salty. The Caspian Sea is like this. It has shrunk drastically as more and more irrigation water has been taken from the Volga and Ural rivers which feed it.

A crater lake is one which lies in the natural hollow of an old volcano. The Eifel district of north-west Germany has hundreds of lakes lying in extinct craters. One of the rarest crater lakes is Lake Bosumtwi in the Ashanti Crater in Ghana. The crater was probably made by a meteorite.

Glacial lakes form where ice-sheets and glaciers have left the ground very uneven. They scraped and hollowed out hard rock or dumped sand, gravel and clay in uneven layers. Finland is a country of such lakes. Northern Canada and north-west England have similar lake districts.

Rift valley lakes are long thin lakes such as Lake Malawi, Lake Turkana and Lake Tanganyika in East Africa, the Sea of Galilee in Israel and the Dead Sea between Israel and Jordan. When the Earth's crust slipped down between long lines of faults, the water filled part of the valley floor.

Artificial dams have created lakes. People have built earth, stone and huge concrete dams to hold back rivers for water supply, irrigation or hydroelectric power. Lakes may form in disused gravel pits and mines. Often they are used for leisure and water sports, or to attract wild birds. Probably the most famous of all lakes in volcanoes is the Crater Lake in Oregon, USA, which is 9 km across. Largest lake.

Caspian Sea, 371,000 sq km

Largest freshwater lake.

Lake Superior, 83, 270 sq km (border of Canada and USA)

Deepest lake.

Lake Baykal, 1,741 m deep

Highest navigable lake.

Lake Titicaca, 3,811 m above sea-level (in the Andes of Peru and Bolivia)

Largest temporary lake.

Australia's lake Eyre, a desert lake 9,300 sq km in area. It disappears completely after a few dry years.

OCEANS AND SEAS.

The five major oceans are the Arctic, Atlantic, Pacific, Indian and Southern Oceans. They are connected to each other by open water. Water slowly circulates between them in currents at the surface and deeper down. The oceans contain about 1,370 million cubic km of water altogether. The average depth of this water is 4,000 m, but in some ocean trenches it may be 11,000 m deep.

The ocean floor has a landscape of its own. Much of the deep sea-bed is a flat plain. But in places, mountains rise thousands of metres from the seabed, sometimes pushing through the sea's surface as islands. Many of these are active or extinct volcanoes. Running down the centre of the ocean floor in several of the oceans is a ridge of mountains which is continually being built up by outpourings of lava. As the rock is forced outwards from the ridge by the new lava, the ocean floor spreads until it reaches the boundaries of the continents.

At the edge of each continent is a shallow shelf which slopes gently down to about 200 m, then dips steeply down, in some cases to a deep trench which marks the point where the ocean floor is being forced under the continent.

Much of the ocean floor is covered in sand or mud brought in by rivers. In places, hot springs bubble up, depositing sulphur and other minerals. Millions of microscopic plants and animals live in the surface waters. When they die, their glassy or chalky shells sink down to the bottom to form a sediment. Here, the pressure of other sediment layers slowly turn the sediments into rocks. Future upheavals of the Earth's crust may one day fold these rocks into new mountain ranges and new land.

The water in the oceans is constantly moving, driven by winds, waves, tides and currents. It may be moving in different directions and at different speeds at different depths. Where the wind blows from the same direction for most of the year, it is able to move large volumes of water, forming surface currents. But the spinning of the earth on its axis makes these currents turn to the right in the northern hemisphere, and to the left in the southern hemisphere. So, the surface currents move in giant circles called gyres. If you mix oil and water, the oil floats on the top because it is less dense than the water. Warm water is less dense than cold water, and salty water is denser than fresh water. In the oceans, cold or salty water sinks, and this sets up deep currents.

In the tropics, the warm surface waters are pushed into two great westflowing currents by the north-east and south-east trade winds. Between them, the equatorial counter current flows in the opposite direction to compensate. Where these currents reach the continents, the rotation of the earth forces them into clockwise circles in the northern hemisphere, and anticlockwise circles in the southern hemisphere.

Nearer the poles, these circular currents meet cold water flowing from the melting ice, and return to the equator as cold currents. Where cold water wells up from the deep ocean, it brings nutrients which support large stocks of fish. Warm and cold currents also affect the climate of coastal countries.

Waves are caused by wind blowing over the surface of the water, pushing against ripples and making them bigger. The water in a wave does not move from place to place. Each water particle moves in a circle, up and forward on the wave crest, then down and back as the wave passes. The longer and stronger the wind blows, and the greater the distance over which it blows, the higher will be the waves. Big waves are further apart than small waves and move faster.

SCIENTIFIC COMMUNICATION

Exercise XVIII. Give English equivalents of the words in brackets.

PRECIPITATION

(Розуміння) of the solubility rules is necessary to intelligent laboratory work. Otherwise, it becomes a matter of following a «cook-book» recipe without knowing what (трапляється) or why. (Розгляд) of the principles of precipitation is recommended as you work on qualitative analysis. The varying solubilities of metallic chlorides, hydroxides, sulphides, and carbonates (дозволяють) us to classify metallic ions into six groups. (Присутність) of ions in each of the groups is detected (за допомогою) of selective or group tests. Once a positive test for a group is obtained we used specific, or (позитивні) tests to identify which particular member of that group is present in the unknown solution. (Подібний) plan is used for identification of the non-metallic ions. These (класифікуються) into four groups. Precipitation plays an important part in their (елементній) identification.

Exercise XIX. Insert the missing words given below.

Acidic, hydrolysis, dissociate, types, degree, dissolve, acid, attractive, basic, base, buffer, base, hold

HYDROLYSIS AND IONIC THEORY

When certain salts ... in water, the solution becomes ... or ... This is called ... As a result, ions from certain salts can be used in ... solutions as common ions with a weak ... or a weak ... The use of ammonium chloride is an example. Ionic salts ... in water to release positive and negative ions because the ... action of water dipoles overcomes the electrostatic attraction tending to ... the ions in the solid state. Therefore, ... of bonding, the nature of solution mechanism, are involved in our understanding of the procedure used in qualitative analysis.

Exercise XX. Complete the following sentences.

1. Ions with positive charges are called ...
2. Ions with negative charges are called ...
3. A conducting solution is electrically ...
4. It contains both ... and ...
5. When certain salts dissolve in water, the solution becomes ... or ...

Exercise XXI. Use the words and phrases supplied below to make up extensive answers to the questions.

1. In what analysis is the common ion effect applied in various ways?
   (small changes, considerable effect of precipitation, weak acid, to separate metallic ions into groups, decreasing or increasing the concentration of the hydroxonium ions, an application of Le Chatelier's Principle).
2. What confirming tests are used for the identification of metals in qualitative analysis?
   (characteristic colours, metallic ions, Bunsen flame, the presence of a particular ion, to result in).

Exercise XXII. Restore questions to the following text.

USING TOO MUCH REAGENT

Many students feel that if a little reagent is useful, a large quantity is even better. This belief can be fatal to good results in qualitative analysis. Too much of a reagent may cause a precipitate to dissolve again. One example is in the use of hydrochloric acid to precipitate the Group 1 metallic ions (Ag^{+}; Hg^{2+}; Pb^{2+}). Addition of too much of a certain reagent may also interfere with tests which follow. Another pitfall in using more of a reagent than is needed is that you may dilute the unknown to a point where positive identification of the ions is impossible.

Exercise XXIII. Say what will happen if:

1) you use too little reagent;
2) you use an impure reagent;
3) you wash precipitates improperly.

Exercise XXIV. Give an example of the use of the common ion in a qualitative analysis.

Exercise XXV. Give an example of the principles of chemical equilibrium application.

Exercise XXVI. State Le Chate tier's Principle and give one example of its application to qualitative analysis.

Exercise XXVII. Report on the function of C^{12} water in the iodide test, the function of HCl in the Group II cation test, the function of $AgN0_3$ in the Group III anion test.

Exercise XXVIII. a) Speak about the procedure of choosing solvent as if you are demonstrating it before your groupmates. b) Briefly report on the experiment you have performed in choosing solvent.

CHOICE OF SOLVENT

Most organic compounds do not ionise in water and it is only possible for them to dissolve if they contain functional groups, which are able to form hydrogen bonds with water molecules. Organic compounds, which do not possess hydrogen-bonding properties usually, dissolve in solvents of a similar nature. The ideal solvent should be safe to use and economical, readily, dissolving the solute when hot but only sparingly in the cold. Wash the product in the Buchner funnel with cold water. Transfer the solid to a flask containing a minimum of ethanol and assemble the apparatus. Gently boil the mixture and continue to add small quantities of solvent until a clear solution is obtained. Filter to remove any insoluble impurities. To avoid premature crystallisation it is essential to heat the funnel and carry out the filtration as rapidly as possible using a Fluted Filter Paper. Excess solvent may be removed by evaporating the filtrate down to the required volume before crystallising. Allow the solvent to cool slowly and filter your product using suction filtration. Wash the product with a small quantity of chilled solvent.

Supplementary text

SPECTROSCOPIC PROPERTIES OF CATIONS

You know the characteristic colours, which certain metallic ions impart on the Bunsen flame. We use these colours as confirmatory tests for copper, barium, strontium, sodium, and potassium ions. Other confirming tests are also used. Flame test is one of the most important. It is a very specific test, as only the presence of a particular ion will result in the flame colour associated with it.

A compound known as borax, with the chemical name of sodium tetraborane, $Na_2B_40_6x4H_20$, may be used to form a clear, glass-like bead to which certain metallic ions impart a characteristic colour. If a platinum wire with a loop on the end is dipped into powdered borax swells, it loses its water of hydration, and fuses into a clear bead. The bead is cooled, dipped into the unknown solution, and then heated strongly in an oxidising flame. The metallic oxide formed reacts with the borax to impart a characteristic colour to the bead. The borax bead test is helpful in identifying a few of the metals we will encounter in qualitative analysis.

Exercise XXIX. All of the following can be find in the text except:

a) cobalt nitrate solution is used for the colour identification of certain metals;
b) we know the characteristic colours which certain metallic ions impart on the Bunsen flame;
c) the flame test is a very specific test as only the presence of a particular ion will result in the flame colour associated with it.

Exercise XXX. The author is primarily concerned with:

a) the nature of solution mechanism;
b) the types of bonding;
c) the borax bead test;
d) the degree of solubility.

Exercise XXXI. Which of the following is not mentioned in the text?

a) an understanding of the solubility rules;
b) an identification of positive and negative ions;
c) a common ion effect;
d) the borax bead test.

Exercise XXXII. Does the passage supply information for answering the following questions?

a) How are positive and negative ions identified?
b) How is the presence of ions in each of the groups detected?
c) What effect has small changes in the pH of a solution?
d) What tests are used for the identification of some metals?

Exercise XXXIII. Read the text given below, and then role-play the head of the research team monitoring some remote site of contaminated soil.

You are in doubt what tactics of sample testing, storage and transportation to choose. Write the email message to the mobile onsite laboratory asking for their expertise in the analysis. Do not forget to indicate the way of payment for their service (credit card, money order, bank money transfer and check).

MODERN TRENDS IN ENVIRONMENTAL ANALYSIS

Time is money — this saying works perfectly well in modem science. To save money and time, numerous onsite environmental mobile laboratories have been developed in recent time to meet the needs of quickly changing world and environmental situation. These onsite services are normally integrated with base laboratories having sophisticated equipment and well-trained personnel. Getting in touch with onsite consultants via email or Internet, you can receive their advice whenever you are in doubt which equipment to use and what testing protocol to apply.

They will tell you which analytical techniques will be appropriate in this particular situation, what types of containers should be used, and will provide expertise for the storage, preservation or transportation of the samples. The onsite environmental mobile laboratories are indispensable when tests are to be carried out in remote places of our planet with no access to fully equipped facilities and lack of qualified personnel.

Exercise XXXIV. Making a phone call is not always easy, international call in particular.

So, find below some expressions, which might be helpful in phone conversations. Role-play a phone talk in which you are trying to get in touch with Mr. Black, secretary of the Organising Committee of International Students' Conference. To simulate the situation, sit back -to-back, please.

Hello, is that Mr. Black?
Hello, this is Mr. White calling from Rice University, Texas.
Hello, my name is Peter White, I am calling from Rice University, Texas.
Can I speak to Mr. Black, please?
Is Mr. Black available, please?
I am trying to reach Mr. Black.

In response you can hear the following:

Hello, Mr. White, hold on a moment, please.
I'll get you through to Mr. Black.
I am afraid, Mr. Black is not available at the moment.
Sorry, Mr. Black isn't here at the moment.

Can I get your number, please, and we'll call you back in half an hour.
Can you call back in half an hour, please?
Do you want to leave a message for him?
Sorry, the wrong number.

The situation gets even worse, when you have to speak to an answering machine. It usually tells you that: you reached the definite number, that a host is not available at the moment, that nobody is at home at the moment, and offers to leave your message after the beep. So, you may hear something like this: «You reached 45387987. Vie can't answer your call right now. Please, leave your message after the beep, and we'll call you back as soon as possible. To leave a message for Mr. Norman, press 1, to leave a message for Mrs. Reed, press 2. Thank you.»

Imitate the conversation with an answering machine. You are calling Mr. Norman who is in charge of Students' Financial Aid Office to ask about the documents needed to apply for scholarship at your university. Mr. Norman is not available at the moment.

Please, find below some useful words from telephone call glossary. Try to guess their meanings.

Pick up a receiver, call back, a phone book/directory, to put smb. through to, area code, bad line, busy (US)/engaged (UK), collect call (US)/transferred charge call(UK), extension, outside line, person-to-person call (US)/personal call (UK), switchboard operator, wrong number, unobtainable, dialing.

Role-play the telephone conversation between Mr. Reed and Mr. Jones.

Mr. Reed is the Secretary of the Organising Committee of the Students' conference at Ohio State University. Mr. Jones is a student of New York University who wants to participate.

Mr. R.: Say hello. Introduce yourself.
Answer. Offer to send electronic abstracts.
Much faster and more convenient.
Yes. Ask Mr. J. if he needs a letter of invitation to apply for financial support at his university to come to the conference.
Yes. Express your gratitude.
Say good-bye.
Reply.
Say good-bye.
Mr. J.: Say hello. Introduce yourself. Ask Mr. R. about the deadline for sending abstracts.
Answer. Ask Mr. R to send you rules of electronic submission of abstracts.

Exercise XXXVIII. *Read and discuss.*

ON THE HISTORY OF CHEMISTRY IN UKRAINE

The development of analytical chemistry in Ukraine is closely connected with the name of Prof. S. Reformatsky. S. Reformatsky worked at Kiev University founded in 1835. In 1899 he published «Tables of Qualitative Chemical Analysis», in which he developed a systematic approach to the analytical experiment. In 1904 professor Reformatsky defined tasks of qualitative analysis as follows: first fmd groups of elements, then determine the role of each element in the molecule, and finally, determine individual substances.

Unit Twelve

Exercise I. *Pronounce the following word combinations:*

unusual fascination
continual search
moral value
scurrilous individual
apparent transmutation
sharp spike
scientific observation
important contribution

Text A

PHILOSOPHY OF EARLY CHEMISTS

Keywords: *gold, transmutation, change, artificial, search, philosopher's stone, alchemist, trick, illusion, impression, challenge, replacement, contribution, belief.*

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

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

Actually at that time, every man who tried to study secrets of nature was thought to be a magician. People believed that Albertus Magnus, a very famous alchemist of his time, could change course of the seasons. They said that Albertus Magnus wanted to build a monastery not far from Cologne, but the Prince refused to sell him the land. So, Albert invited the Prince and his court to come to the very special entertainment that he organised at his house in their honour.

The Rhein was frozen and the winter was very severe then. The Prince and his knights were almost frozen to death when they finally came to Magnus house. Great was their surprise when they saw a repast spread in the garden, the garden that was filled with songs of beautiful birds and the shining sun. The trees began to cover with fresh green leaves, and it was very warm. The Prince was fascinated with all those wonders and agreed to give the land to the great magician.

During the early Renaissance some began to challenge Aristotelian theories and attempted to explain many chemical reactions in atomic terms. For instance, it was realised that the replacement of iron by copper in a copper sulphate solution was not really transmutation. It was only the exchange of atoms.

Pierre Gassendi (1592—1655) was an anti-Aristotelian who believed in the existence of atoms, but he thought that their size and shape could account for all the properties of matter. Nicolas Lemary (1645—1715) used similar ideas to explain physical and chemical properties of substances. Lemary claimed that acids had sharp spikes on their atoms which accounted for the pricking sensation they exert on the skin.

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

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

VOCABULARY AND COMPREHENSION

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

1. Where did the belief that the gold could be made by transmutation of other metals originate? 2. What stimulated alchemists' continual search for the philosopher's stone? 3. What groups were alchemists divided into? 4. How could alchemists easily demonstrate the apparent transmutation of metals? 5. How did Michael Senivogious defraud people? 6. What did Pierre Gassendi think about atoms? 7. What ideas did Nicolas Lemary use to explain chemical and physical properties of substances? 8. What contributions did van Helmont make?

Exercise IV. In what line of the text do you read:

1) that it was man's great desire for gold and his belief that it could be made artificially which stimulated alchemists' continual search for the philosopher's stone; 2) that alchemists were divided into two groups with opposing moral values; 3) that there were many tricks which alchemists used to give the illusion of successful transmutation to gold; 4) that it was realised that the replacement of iron by copper in a copper sulphate solution was not really transmutation; 5) that Pierre Gassendi was an anti-Aristotelian who believed in the existence of atoms; 6) that van Helmont made several important contributions to the development of early chemistry.

Exercise V. Write down the definitions of: transmutation, philosopher's stone, replacement.

Exercise VI. Note carefully definitions of the following words.

Originate
Search
Oppose
Exist
Attempt
Recognise
Impress
Change
Explain
Manage
Convince

- *to bring into existence.*
- *to look over or through in order to find smth.*
- *to set against, contrast, resist, withstand.*
- *to be, continue to be.*
- *to try, to make an effort or attack on, endeavour.*
- *to know again, treat as valid, notice.*
- *to affect deeply.*
- *to alter, make different.*
- *to think over, make clear, put into words, give details.*
- *to succeed in doing, conduct affairs.*
- *to satisfy, succeed, bring to a belief.*

Exercise IX. Choose the one word that best keeps the meaning of the original sentence.

1. The belief that gold could be made by the transmutation of other metals such as lead and mercury, *originated* from the teachings of Aristotle.
   a) came
   b) appeared
   c) was recorded
   d) was studied
2. Aristotle believed that all metals could be *changed* into gold.
   a) converted
   b) transmuted
   c) stimulated
   d) arranged
3. Alchemists were divided into two groups with *opposing* moral values.
   a) the same
   b) different
   c) similar
   d) perfect
4. An alchemist could *easily* demonstrate the apparent transmutation of metals by placing an iron nail into a copper sulphate solution.
   a) with difficulty
   b) readily
   c) hardly
   d) eagerly
5. There were many *tricks* which alchemists used to give the illusion of a successful transmutation to gold.
   a) ways
   b) frauds
   c) possibilities
   d) explanations

Exercise X. Translate the following sentences. Be sure that you know the meanings of the following words.

Throughout — у всіх відношеннях, усюди.

Through — через, крізь.
Though — все ж таки, однак, хоча.
Thorough — повний, досконалий, ретельний.

1. The investigation or experiment should be repeated, perhaps, hundreds of times, for a thorough scientific experiment. 2. This idea, though wrong, is still rather important. 3. A solution is homogeneous because the substance, which is dissolved, is scattered evenly throughout the liquid. 4. Even though the particles in a liquid have freedom of motion, they are almost as close together as they can get at room temperature. 5. Any given molecule will collide with many other molecules, while making its way through the liquid.

Exercise XI. Say which of the statements is correct.

1. Gold has always held an unusual fascination for people throughout the ages. 2. Copper has always held an unusual fascination for people throughout the ages.

1. Aristotle believed that all things tended to reach state of perfection. 2. Aristotle believed that some things tended to reach state of perfection.

1. It was man's great desire for gold and his belief that it could be made artificially. 2. It was man's great desire for gold and his disbelief that it could be made artificially.

1. Even in the 19th and 20th centuries many people still believed in transmutation. 2. Even in the 19th and 20th centuries a few people still believed in transmutation.

1. It was realised that the replacement of iron by copper in a copper sulphate solution was not really transmutation. 2. It was realised that the replacement of iron by copper in a copper sulphate solution was obviously transmutation.

1. Van Helmont still retained a belief in the possibility of transmutation. 2. Van Helmont lost a belief in the possibility of transmutation.

WORD-BUILDING

Exercise XII. Define from which words the following adverbs are formed. Translate them.

Artificially, actually, honestly, readily, really, truly, efficiently, easily, constantly, naturally, energetically.

Exercise XIII. Form the adjectives using the following suffixes:
-ful: success, care, help, use, rest;
-able: desire, explain, depend, change, value.

Exercise XIV. Form and translate nouns using the given suffixes:

-ion, -sion, -tion: fascinate, accelerate, transmute, continue, demonstrate, evaporate, impress, explain, observe, contribute;
-ment: replace, develop, accomplish.

Exercise XV Make the following transformations according to the model: transmutation of metal — metal transmutation

State of perfection, nail of iron, illusion of transmutation, impression of conversion, replacement of iron, exchange of atoms, development of chemistry, possibility of transmutation.

Text B

Water is a structural component of our body, as well as all organisms of the biosphere. In their relation to water all branches of economy are divided into users and consumes. The former use water as media without taking it out of the source (water transport, hydropower plants) which the latter do for drinking, cooking, etc.

Water problem acquired global international scale. In our days water is an item of international trade. Industrial enterprises use water in large quantities. The greatest consumers of water are chemical plants, cellulose-paper mills and enterprises of non-ferrous metallurgy. The rate of pollution of sweet water basins is high. At present over 90 mln tons of mineral fertilizers and more than 2 mln tons of toxic chemicals are spread in water basins. Oceans and seas are sewage collectors poisoned with radioactive wastes. Statistics says that nearly1.5 billion people lack safe drinking water and that at least 5 million deaths per year can be attributed to waterborne diseases.

With almost 80 percent of the planet covered by oceans, most coastal waters are now polluted. Beaches around the world are closed regularly, often because of high amounts of bacteria from sewage disposal, and marine wild life is beginning to suffer. Since the middle of the nineteenth century there has been a continual development of our knowledge of the effects of pollution and the means by which it may be prevented or controlled. The problem has become especially acute in the second half of the twentieth century when in the USA water in a number of lakes and rivers proved to be already undrinkable. The living resources of the sea are renewable. If managed rationally they could provide food and materials probably forever. The only way to overcome the catastrophe of water pollution is to put an ocean to a greater international control. The territorial waters should come under a new ocean regime. Under this regime the mineral and other resources of the ocean would become reserves and could be used by following generations.

When something harmful is added to the environment, it causes the pollution. As a result of the antropogenic activity atmosphere pollution happens, which results in changes in atmosphere air chemical composition. The appearance of the supersonic jet airliners has presented many problems. These airliners use up tones of oxygen and throw out over 150,000 tons of water vapor into the stratosphere every day, increasing the temperature. It has to be decided if this is right in ecological terms. Space flights that break through the atmosphere envelope should be studied as to their effects on nature. A significant portion of industry and transportation is based on burning fossil fuels, such as gasoline. As these fuels are burned, chemicals and particulate matter are released into the atmosphere.

The most common substances which pollute the air contain carbon, sulfur and nitrogen. These chemicals interact with one another and with ultraviolet radiation in sunlight in various dangerous ways. Smog, usually found in urban areas with large numbers of automobiles, is formed when nitrogen dioxide is broken down by sunlight, releasing ozone and other harmful substances. Smog can cause serious health problems. When sulfur dioxide and nitrous oxide are transformed into sulfuric acid and nitric acid in the atmosphere and come back on earth in precipitation, they form acid rain.

Air pollutions are classified as organized and non-organized, heated and cold, principal or supplementary production, unpurified and purified wastes.

Acid rain. Acid rain is a serious global problem because few species are capable of surviving in the face of such acidic conditions. It comes from industrial countries, but wind carries it and a lot of falls on these countries' neighbors. Acid rain is a type of pollution which may take the form of snow, fog, or a dry form of precipitation and they can be carried long distances from the source before they are deposited. Acid rain has made numerous lakes so acidic that they no longer support fish populations. Acid rain is also thought to be responsible for the decline of many forest ecosystems worldwide.

GRAMMAR STRUCTURE

Relative Clauses

Review of the Perfect Tenses

There are two types of relative clauses in English: identifying and non-identifying clauses. The first type identifies a thing or person in the same sentence. No comma is used before that, who and which.

The CV that I sent you yesterday needs some corrections. The person who called me is my boss. The guy that I met at the museum is my classmate.

You can omit that, who, which if a subordinate clause has its subject: The letter (that/which) I mailed you is very important.

Normally, you have to use commas in non-identifying clauses, which give some additional information about a person or thing: The application form, which is enclosed in this letter, must be returned immediately. Please, call Mr. Banta, whose extension number is 444.

Please, decide, if you should put commas in the following sentences.

John who lives next door likes golf and tennis. I applied for a job that was advertised in US Weekly. The CV which was enclosed in the letter is very important. Jim Thompson who works for Big Pictures USA is a good friend of mine. Unfortunately, the letter in which your documents were sent has been lost. The interview which I had three days ago was very friendly. Carl who was bom in Mexico now lives in London.

Exercise XVI. Define the functions of the verb «to have». Translate the following sentences.

1. It has been estimated that about 0.000015 gr. of iodine daily in the form of inorganic salts will meet the requirement of adult human beings. 2. The hexose phosphates have an important function in the intermediary metabolism of carbohydride. 3. The colour of many flames has nothing to do with heat and a lot to do with the chemicals present. 4. The statue of Amour has stood in Piccadilly Circus, London, since 1893. The statue has suffered no corrosion over the past century. 5. It is interesting to note that the explosive nature of fulminates has claimed many victims throughout the history of chemistry. 6. Practising chemists have difficulties with the concept of «amount» in chemistry.

Exercise XVII. Change the Present Perfect Tense into the Past Perfect Tense, using appropriate adverbials and phrases.

1. Staudinger has been trained as a classical organic chemist. 2. He has shown that the organic substances retained their colloidal nature in all solvents in which they dissolve. 3. Staudinger and others has accumulated much evidence in favour of macromolecular hypothesis. 4. Now that the dimensions of polymer molecules have been measured by so many different techniques, there can be no doubt that these giant molecules really do exist. 5. You have already written equations using words. 6. We have seen how chemists measure the heat of reaction. 7. We have already observed that there are many close similarities between a gas and a collection of particles in endless motion. 8. We have mentioned the electrical conductivity of solutions as a means of distinguishing solutions. 9. We have already learned that nature has great variety. 10. Experiments have been performed in which individual electrons and protons have been weighed.

Exercise XVII. Open the brackets using the Present Perfect Tense or the Past Simple Tense.

1. The early chemists (to organise) the elements according to convenience and practical use. 2. You already (to experiment) with some families. 3. You (to come) a long way in your study of chemistry. 4. You just (to complete) to observe the volumes of hydrogen for the reactions of magnesium and sodium. 5. You may (to wonder) why water is always H_20, and never H_50 or HO or $H0_2$ 6. We never (to use) acids of different concentrations.

Exercise XIX. Complete the following sentences using the Present Perfect Tense.

1. There is evidence that sucrose decomposed. (The experiment, to be completed, successfully, this month). 2. He makes many mistakes in his report. (He, to miss, this term, laboratory lessons). 3. She cannot show you how to separate the contents of the test tube into the two original substances. (She, never, to do, this work). 4. He has good results. (He, to study, for a month, this problem). 5. The elements are grouped by their similar properties. (Different elements, just, to group, we). 6. We are able to determine which elements react similarly. (We, already, observe, the reactions of various compounds). 7. A variety of useful compounds contain fluorine. (We, recently, to study, the Halogen family).

Exercise XX. Answer the following questions using the Present Perfect.

1. I am completing the experiment. And you? 2. They are installing the new equipment in their laboratory. And you? 3. I am looking through new material. And you? 4. We are writing a report of our ammonium chloride experiment. And you? 5. We are measuring the temperature of water now. And you? 6. They are copying the data of the experiment in their notebooks. And you? 7. He is recording the mass of the solution. And you? 8.1 am removing the test tubes from the balance. And you? 9. She is explaining the difference between recording and reporting results. And you? 10. We are trying to dissolve two white solids in equal amounts of water. And you? 11. They are examining some sand crystals with hand lenses. And you?

Exercise XXI. Pick out the sentences with the Perfect Tenses.

The scientist assembles his facts; he translates his data into constructs that he invents for the purpose according to certain rules that experience has shown to be useful. He then assembles these constructs, frequently using the language and methods of mathematics, into a theory and, finally, he verifies the theory by deriving from it new conclusions that can be determined by observation. The evolution of the scientific method has depended on the realisation of the importance of these operations and, particularly, on the importance of verification before any theory is allowed to fit into the existing pattern of scientific knowledge.

Exercise XXII. Restore the questions to the following text.

The writings of Aristotle had been kept alive during the Dark Ages of Europe by translation into Arabic and by preservation by the Arabs, who had swept over Africa and through a great part of Spain. No true eclipse of learning had occurred among the Arabs, whose cycle of civilisation was in different phase from that of the western world. The writings of many of the Greek authors had been translated into Arabic through Syriac, which was the language in many parts of the Byzantine Empire and had replaced Greek in Western Asia.

SCIENTIFIC COMMUNICATION

Exercise XXIV. Give English equivalents of the words in brackets. Be sure that you understand the text.

(Основні) principles of chemistry date not from the seventeenth but from the end of the eighteenth and the beginning of the nineteenth centuries. The delay in the development of chemistry may be (віднесений) to two different causes. The minor one is that experimental chemistry (потребує) access to equipment and materials. In the days, when there were no electricity and gas, heat could be (одержано) only by burning wood or coal, and no supply of suitable heatproof (хімічного посуду) was available. It was (необхідно) for the chemist in most cases to prepare his own materials, and these were usually very (забрудненими). A second and more important (причиною) of the delay in the advance of experimental chemistry was that it got off to a wrong start. The earliest chemists were alchemists, who (намагалися) to find the philosopher's stone or to transmute metals. They were, in fact, anxious to work on (практичній) chemistry, and their efforts to apply chemistry (замість) observing and studying the facts delayed (відкриття) of the nature of the reactions that constitute the science of chemistry.

Exercise XXIV. Divide the text into sense parts and entitle each of them.

Exercise XXV. Write a report on your experiments to simulate some tricks of alchemists.

Exercise XXVI. Describe some tricks of alchemists.

Exercise XXVII. Translate the following sentences.

1. Хоча алхіміки не змогли знайти філософський камінь, вони заклали основи хімічних знань для майбутніх вчених. 2. Багато речовин, що добре відомі сьогодні, було вперше відкрито та застосовано алхіміками. 3. Три мінеральні кислоти — оцтова, сірчана та соляна — широко застосовувалися алхіміками. 4. Такі елементи, як фосфор, миш'як, цинк досліджувалися алхіміками.

Exercise XXVIII. Use the words and phrases supplied below to make up extensive answers to the questions.

1. What was Aristotle's teaching about the state of perfection? (Unusual fascination, throughout ages, transmutation of metals, to be originated from, to reach the state of perfection, to be changed into gold, the most perfect, to be made artificially). 2. On what principle were alchemists divided into two groups? (Opposing moral values, the existence of the philosopher's stone, to strive to discover, scurrilous individuals, to be able to transmute metals, in reality, to deceive nobility, to make fortunes, to show little comparison). 3. What were the tricks which alchemists used to give the illusion of a successful transmutation to gold? (To manage, to coat coins, over a fire, to cause the mercury to evaporate, to give the impression, to be converted into gold).

Exercise XXIX. Dispute the problems given below.

1. The alchemist in most of art and literature works is portrayed as a lonely charlatan whose deluded experiments to discover the philosopher's stone were recorded under a mystical and intentionally obscure terminology. 2. The belief of many scientists (Robert Boyle and Isaac Newton among them) in transmutation.

Exercise XXX. *Render the text «Philosophy of Early Chemists».*

Supplementary text

GREEN YEARS OF SCIENCE

Through the ages we see an increase in man's understanding of nature and his control of natural forces. Astronomy started as astrology, but this involved the observation of the positions of the heavenly bodies and, thus, led to astronomical determination of time and the establishment of a calendar. Moreover, from observations of the stars it was possible to form an idea of world geography; and this made possible the development of navigation away from the coasts. Practical metallurgy led into chemistry, for which alchemy played the part that astrology played for astronomy. Thus, step by step, science advanced through the ages until we reached the seventeenth century. Then, there was a sudden and definite change in the rate of learning. The experimental method of research was discovered, and the advance in scientific method and knowledge became much more rapid.

The Copernican revolution, which displaced the earth from the ancient seat at the centre of the Universe, is often cited as the beginning of modem science. Copernicanism corrected an error dating to old Greeks by substituting the sun for the earth as the centre of the solar system.

Exercise XXXI. The author is primarily concerned with:

a) nature of scientific theory;
b) an increase in man's understanding of nature;
c) the creation of scientific knowledge;
d) the application of science.

Exercise XXXII. Which of the following is not mentioned in the text?

a) astronomy started as astrology;
b) practical metallurgy led to chemistry;
c) IIIe method of science is the accumulation of facts;
d) the special activity of mankind, which we call science, began as a classification of facts.

Exercise XXXIII. *The passage suggests that:*

a) the observation of the positions of the heavenly bodies led to astronomical determination of time and the establishment of a calendar; b) from the observations of the stars it was possible to form an idea of world geography; c) scientific knowledge arises from certain characteristics in the mind of man which cause him to seek to understand phenomena; d) one of the most interesting systems of incorrect association of facts is known as magic.

Exercise XXXIV. Read and discuss the text about the glorious past of physics.

ON THE HISTORY OF PHYSICS

The grandeur of physics began in ancient time. The time of Ptolemy's «Great Mathematical Syntax of Astronomy» is the best time to begin with.

The science of the stars was dominated by a principle formulated by Plato and the Pythagoreans, according to which all the phenomena presented to us by the heavenly bodies must be accounted for by combinations of circular and uniform motions. Moreover, Plato declared that these circular motions were reducible to the rotation of solid globes all limited by spherical surfaces concentric with the World and the Earth, and some of these homocentric spheres carried fixed or wandering stars. The fundamental hypothesis of homocentric spheres was incorporated in Aristotle «Physics» and «Metaphysics».

However, the astronomy of homocentric spheres could not explain all celestial phenomena, a considerable number of which showed that the wandering stars did not always remain at an equal distance from the Earth. Heraclides Ponticus in Plato's time, and Aristarchus of Samos about 280 B. C. tried to account for all astronomical phenomena by a heliocentric system, which was an outline of the Copemican mechanics; but the arguments of physics and the precepts of theology proclaiming the

Earth's immobility, readily obtained the superiority over this doctrine which existed in a mere outline. Then the labours of Apologias Pergeus (at Alexandria, 205 B. C.), of Hipparchus (who made observation at Rhodes in 128 and 127 B. C), and finally of Ptolemy (Claudius Ptolemeus of Pelusium) constituted a new astronomical system that claimed the Earth to be immovable in the centre of the universe. Between A. D. 142 and 146, Ptolemy wrote a work called *Megale mathematike syntaxis tes astronomies,* its Arabian title being transliterated by the Christians of the Middle Ages, who named it «Almagest». The astronomy of the «Almagest» explained all astronomical phenomena with a precision which for a long time seemed satisfactory.

In Ptolemy's time the physics of celestial motion was far more advanced than the physics of sublunary bodies, only two chapters had reached any degree of perfection, namely, those on optics (called perspective) and statics. The law of reflection was known as early as the time of Euclid, about 320 B. C., and to this geometrician was attributed, although probably erroneously, a «Treatise on Mirrors», in which the principles of catoptrics were correctly set forth. Dioptrics, being more difficult, was developed less rapidly. Ptolemy already knew that the angle of refraction is not proportional to the angle of incidence, and in order to determine the ratio between the two he undertook experiments the results of which were remarkably exact.

Statics reached a fuller development than optics. The «Mechanical Questions» ascribed to Aristotle was a first attempt to organise that science, and it contained an outline of the principle of virtual velocities to justify the law of the equilibrium of the lever. Archimedes (about 287—212 B. C.), raised it to a still higher degree of perfection. It will here suffice to mention the works of genius in which the great Syracusan treated the equilibrium of the weights suspended from the two arms of a lever, the search for the centre of gravity, and the equilibrium of liquids and floating bodies. The treatises of Archimedes were too scholarly to be widely read by the mechanicians who succeeded this geometrician; these men preferred easier and more practical writings as, for instance, those of Aristotle «Mechanical Questions». Various treatises by Heron of Alexandria have preserved for us the type of these works.

Exercise XXXV. *Read and discuss.*

ALCHEMY AND ARTS

Both art and literature have immortalised the figure of the alchemists. Vividly portrayed on canvas by numerous 16th and 17th century European artists, such as Thomas Wyck, Joseph Wright and David Teniers, the alchemist featured in Chaucer's *Canterbury tales,* in the works of Shakespeare, and in Ben Jonson's play, «The alchemists». In most of these works the alchemist is portrayed as a lonely charlatan whose deluded experiments to discover the philosopher's stone — a substance which supposedly converted worthless metals into gold, cured disease, restored health and prolonged life — were recorded under a mystical and intentionally obscure terminology. Alchemy incorporated aspects of astrology and mysticism with the earlier Greek theories of Aristotle, and flourished in the middle ages throughout Europe, Asia and the Middle East where even monarchs, including James IV of Scotland and Charles II of England, practised it as one way of financing their kingdoms.

There is an often quoted comparison between alchemy and one of Aesop's fables which was first observed by Francis Bacon in the 17th century. The fable concerns a man who tells his sons that he has left them gold buried somewhere in his vineyard. Although they found no gold, by digging they turned up the mould about the vine roots and procured a plentiful vintage.

While the alchemists never found their philosopher's stone, collectively they amassed many chemical facts which laid the foundations of chemical knowledge upon which modem chemists, such as Davy, Priestley, Lavoisier and Dalton, could build.

Many common substances used today were discovered and used by the alchemists, including alum, borax, ether, plaster of Paris, cream of tartar, and the salts of many metals. The three mineral acids — nitric, sulphuric and hydrochloric — as well as aqua regia, were all discovered during the alchemy period and were used extensively in the alchemists' experiments. New techniques such as cupellation, distillation and amalgamation were widely used, and equipment, such as furnaces and balances, was introduced. The element phosphorus was discovered, and for the first time antimony, arsenic, bismuth and zinc were recognised as distinct metals.

Exercise XXXVI. Say in your own words Aesop's fable mentioned in the text.

Exercise XXXVII. Continue the list of artists and poets mentioned in the text who immortalised the figure of the alchemist.

Exercise XXXVIII. Comment on alchemists' contribution to chemistry.

Exercise XXXIX. Translate into Ukrainian, entitle and write the thesis statement. Give examples of once popular theories and hypotheses, which later proved erroneous.

The special activity of mankind, which we call science, began as a classification of facts. Certain types of men have a desire to classify facts into patterns, to associate facts with each other and, thus, understand the connections between the facts. The beginnings of science are to be found in a system of classification, in which different facts are associated and regarded as being in the same classification or, as it is usually put, as being due to the same cause. Very often, early man was wrong in his classification, and his association of facts proved later to be incorrect; such incorrect associations have persisted through the ages. The mere observation of facts is not by an) means a simple operation. To be of value, facts must be received by different observers and must be true or acceptable. This, of course, accords with the practice of scientific research, that fact: about which there is any doubt must be checked by different observers. In the history of science many observations have been published that were not accepted immediately as accurate. Some ol them were later agreed to be erroneous; many were confirmed by further study.

*Exercise XL. Please, find below some rules of cell phone etiquette guide. Remember: a cell phone is a great convenience and time-saver, but**...***

Think of other people when using your cell phone in a public place.
Don't take or make calls at the theatre or at the movies, etc. When asked to switch it off do so.
Don't shout in the phone, stop noise pollution!
Act responsibly walking or driving while on the cell phone.

Exercise XLI. Imagine that you have sent your application form and tht resume to some company. Your initial contact with them can bt by the phone. To assist you to make a favourable impression or your may-be employers, here are some tips of phone inter viewing etiquette.

1. A human resources officer / employer may decide to interview you by the phone Be prepared to that. Prepare ahead of time, outline the points. If you were not available when the employer called, return the call within business hours as soon as possible to demonstrate your interest in the position.

2. Be prepared to discuss your qualification, experience, skills, abilities and education.
3. Finally, find out when the employer may contact you again.

Good luck!

Mini-Test

1. Write down 10 keywords of the text.
2. Give the definition of transmutation.
3. Say which of the statements is correct:
   a) It was realised that the replacement of iron by copper in a copper sulphate not really transmutation.
   b) It was realised that the replacement of iron by copper in a copper sulphate not obviously transmutation.
4. Make nouns from the following verbs: accelerate, evaporate, contribute, replace, develop.
5. Make the following sentences interrogative:
   a) Many natural dyes have been known for a long time.
   b) We have already learned that nature has great variety.
   c) Chemists have already studied properties of this compound.
   d) They have never synthesised such materials in the laboratory.
6. Open the brackets and choose the correct tense form of the verbs.
   a) Early chemists (devoted, had devoted) all their time to the search of gold.
   b) Chemistry (passed, has passed) a long way from observation to theory.
   c) Many secrets of crystalline structure (have not been, were not) discovered yet.
   d) The works of Shakespeare, Chaucer, Teniers and many other writers and artists (portrayed, had portrayed) the figure of the alchemist.
7. Ingredients: inch of vinegar, 4 inches of olive oil, yellow of an egg, salad dressing. Give its name.

Mini-Test Rating

Task number	**Rating**
1	**1000**
2	**1800**
3	**300**
4	**200**
5	**600**
6	**400**
7	**400**

Зміст

Навчально-методичне видання

Мороз Л. В.,
Ясногурська Л. М.,
Ковалюк В.В.,
Мічуда Н.М.,
Романюк С.К.

Англійська мова для природничих наук

Навчальний посібник

Технічний редактор:
Владислав Ковалюк

Відповідальна за випуск:
Людмила Мороз

Підп. до др. 26.05.2025.
Формат 60x84 1/8.
Папір офсет.
Друк цифр.
Гарнітура Таймс.
Ум. друк. арк. 17,9.

Видавець Юрій Кукса
Свідоцтво суб'єкта видавничої справи
серія ДК № 8301 від 9 травня 2025 р.
вул. Фабрична, 8, м. Рівне, 33022;
097 42 66 444

Видання розміщене на сайті:
http://repository.rshu.edu.ua/