ENGLISH FOR PHARMACY AND MEDICAL BIOANALYTICS

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English for Pharmacy
and Medical Bioanalytics

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CONTENTS

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PREFACE

This textbook is mainly intended for a four-semester university course both in bachelor and master programs of Pharmacy and Medical Bioanalytics. It is also suitable for users working in pharmacy and related professions.

The book provides a selection of topics that users can find useful at work as well as in their further studies and research activities. The problems of chemistry, pharmacology, biology and medicine are covered. Apart from more theoretical topics, users will also find chapters focused on practical problems they can come across in everyday professional life, usually comparing the Czech pharmaceutical and health-care system to those of some English speaking countries, mainly Great Britain and the USA. There are also included chapters focused on doctor-patient situations as well as effective pharmacist-patient communication. Two final chapters are dedicated to practical issues of job application, Curriculum Vitae, and presentation of one's professional qualities.

The goal of this textbook is to make users acquainted with contemporary and topical vocabulary and problems of pharmaceutical and health-care professions and to provide them with a sound knowledge and a good background for successful reading and communication in English.

The textbook is recommended for users who already have at least intermediate knowledge of English as well as knowledge in the special fields covered in the book.

The textbook is suitable for both classroom use and self-study.

All chapters follow the same format. Each chapter opens with a brief text introducing the topic and related vocabulary. This part of the chapter is followed by exercises meant to practice the vocabulary and sentence structures used in the opening article. The exercises which follow are not only theoretic questions but are also directed towards practical applications. There is a number of conversational exercises, which, under a teacher's supervision hope to enhance students' communication skills and encourage their confidence in using spoken English.

At the end of the chapters users will find a Czech to English translation exercises enabling them to check the knowledge gained in each of the chapters. Grammatical exercises are used as a supplementary part focused on the revision of some of the more advanced grammatical features.

The textbook is equipped with a practical English to Czech dictionary where users will find the specialist vocabulary used in the book.

The authors hope that this textbook will help users to strengthen their existing knowledge as well as gain new information employable in their professional lives.

Authors

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UNIT 1

THE FACULTY OF PHARMACY AND THE COURSE OF STUDY

1.1 History of the Education of Pharmacy

The Prague pharmacists were connected with Charles University from its foundation. They were under the professional supervision of the Rector of Charles University and the Dean and professors of the Faculty of Medicine. There was a one-year pharmacy course, and from 1834 a two-year course. They studied at more than one faculty: at the Faculty of Arts, and the Faculty of Natural Sciences; but the end of their study was always held at the Faculty of Medicine. From 1948 there was a four-year course, but it was cancelled in 1950 and transferred to Masaryk University in Brno. It led to the establishment of the Faculty of Pharmacy in Brno and Bratislava in 1952.

The Faculty of Pharmacy, with its seat in the town of Hradec Králové, was established by a government decree in 1969. The Faculty of Pharmacy has continued in the old and long-time tradition of the education of pharmacy at Charles University.

1.2 Undergraduate Study

The academic year begins on October 1st and it consists of the winter and summer terms/semesters. Each term/semester consists of fourteen weeks of classes which are followed by a four to five week examination period. At present, the course of undergraduate study at the Faculty of Pharmacy takes five years. The programme for undergraduate study makes it possible for students to specialize adequately according to their interests by choosing from recommended and optional subjects besides the compulsory disciplines. It is compulsory to take part in the practical laboratory training and to get through practical placements in pharmacies and other pharmaceutical institutions during the course of studies.

Their knowledge of the subjects is proven by taking examinations to fulfil the required scientific profile of the graduate. The course of studies is concluded by passing the Final State Examinations and by the successful defence of an undergraduate's degree paper. Finally, the graduate is awarded the academic degree of Magister (Mgr.) at the graduation ceremony.

The concept of the programme corresponds with the contemporary state and standard of pharmaceutical sciences, the needs of the pharmaceutical practice in the European context, and it creates a base for postgraduate studies, the course of study that enables one to yield deeper scientific education in a special branch.

1.3 Postgraduate (Doctoral) Studies

Graduates of the studies of pharmacy or of some related discipline (e.g., Faculty of Medicine or Natural Sciences) can apply for admission to the three-year internal or five-year external course of postgraduate doctoral studies. The conditions for admission to postgraduate study are the successful completion of the entrance examination, and at least one professional publication.

The PhD studies involve scientific work in a selected research project under the supervision of distinguished teachers of the Faculty of Pharmacy. The postgraduate course of studies is completed by passing examinations in theoretical topics related to the appropriate research project, and by writing and defending a doctoral dissertation. The Accreditation Committee of the Government of the Czech Republic approved the following fields in which it is possible to obtain the academic scientific degree of Doctor (PhD) at the

Faculty of Pharmacy, Charles University: *Bioorganic Chemistry, Drug Control, Clinical Pharmacy, Gerontopharmacy, Pathobiochemistry and Xenobiochemistry, Pharmacology and Toxicology, Pharmacognosy, Pharmaceutical Chemistry, Pharmaceutical Technology, Social Pharmacy, and Pharmacy Practice*.

1.4 Executive and Management

• Executive Committee
At present the Executive Committee of the faculty consists of the Dean, four Vice-Deans (pedagogical activities, science and research, international relations), and an economic secretary.

• Dean of Faculty
The head of the faculty is the Dean. The official title of Dean used during ceremonies is "Spectabilis". The Dean is elected for a period of three years by the Academic Senate. The function of the Dean is not only symbolic but he is also the head of the Executive Committee, and together with the Academic Senate has the highest responsibility for the faculty's prosperity.

• Scientific Council
The most important advisory body of the Dean is the Scientific Council, which is created by the Dean of the faculty and consists of professors and associate professors of the faculty and of outstanding specialists from the institutes outside the faculty. The Scientific Council deals with problems concerning the concept of the educational and scientific activities of the faculty.

• Academic Senate
The Academic Senate is established in a democratic way. The members of the Academic Senate are elected for a period of three years by the members of the academic community of the faculty (the students and graduate employees of the faculty). The Academic Senate consists of twenty-two members (thirteen teachers and nine students). The Academic Senate has mainly a controlling function.

• Accommodation for Students
The total number of students of the Faculty of Pharmacy in Hradec Králové is almost one thousand. The faculty has Halls of Residence which are very close to the faculty buildings, just a ten-minute walk. The halls represent a wide complex of study facilities, furnished rooms, refectory, club, sports centre, and more.

Exercises

1. Text comprehension.

a) Finish the following sentences:

1. From 1834 to 1950 students of pharmacy used to study at ……
   …… in …….
2. From 1950 to 1952 they used to study at …… …… in …….
3. From 1952 to 1969 they used to study at the Faculties of Pharmacy in …… and
   ……
4. In …… the Faculty of Pharmacy in Hradec Králové was established.

b) Read the first two paragraphs again and find synonyms.

establishment	……	elective (AmE)	…… (BrE)
placement	……	obligatory	……
licence	……	to be finished	……
to keep on	……	student of university	……
nowadays	……	lastly	……

to last	……	to be conferred a title	……
to render possible	……	to be up to	……
sufficiently	……	requirements	……

c) Answer the following questions.

1. What courses are students obliged to attend during their studies?
2. How is their acquired knowledge checked?
3. What will they finish their university studies with?
4. What degree will be conferred on them and where?
5. What kind of study can they apply for after graduation?
6. What does the postgraduate study programme involve?
7. What is the PhD study finished with?
8. Out of how many fields can they choose the topic for research and dissertation?
9. Who have the fields been approved by?

d) Decide whether the following sentences are true or false. Justify your answers.

1. The Executive Committee of the faculty is composed of the Dean, a Vice-Dean and an economic secretary.
2. Students use the official title of the Dean during their course of study.
3. The Academic Senate elects the Dean for a period of three years.
4. Not only the Dean is responsible for the prosperity of the faculty.
5. The professors of the faculty create the Scientific Council.
6. The Scientific Council is concerned with the research and other scientific activities of the faculty.
7. The Academic Senate is the most important advisory body of the Dean.
8. The Academic Senate is elected by students and professors of the faculty.
9. There are nine teachers and thirteen students in the Academic Senate.

2. Check your vocabulary.
Guess the missing words. The first letters should help you.

1. A s …… lists the times of classes, lectures, etc.
2. Students who live in a dormitory at a college are called b …….
3. The head of a college could be called a p …….
4. The function of a school is to e …… children.
5. Have you seen the new s …… for the exams?
6. Some students learn languages with e …….
7. School children receive a r …… at the end of each term.
8. Not all applicants can be a …… to the university if they pass the e…… tests.
9. Before an exam students always r …… what they have learnt.
10. Each exam at our college requires a deep k …….

3. Read the following quotations and explain the meaning.

1. *Education is what survives when what has been learned has been forgotten.*
   ~ B. F. Skinner
2. *Graduation is not the end; it's the beginning.*
   ~ Orrin Hatch
3. *Put your future in good hands – your own.*
   ~ Author Unknown
4. *It is not the mountain we conquer but ourselves.*
   ~ Edmund Hillary

4. Read the short text and explain each of the expressions printed in bold.
Study and Exams

Before an exam you can **revise** or **cram** for it. Some things can be **memorised**. It is also possible to use **mnemonics**. But the best idea is to **bury yourself in your books** until you **know the subject inside out**.

5. Complete the text with the words from the box and explain or translate their meaning.

drop out	**inter-library loan**	**finals**	**carry out**
demanding	**papers/articles**	**cope**	**academic**

Aspects of higher academic study
University academics 1. …… research and are expected to read 2. …… journals, which publish 3. …… on specialised subjects. If a library does not have a book or journal, you can usually get it through 4. ……. Academic study can be very 5. …… and intensive, and students sometimes 6. …… of the course because they cannot 7. ……., but the majority survive till the 8. …….

6. There is one idiomatic expression concerning studies and exams in each sentence. Underline it and choose the right meaning.

1. It's very easy to fall behind in your studies if you miss even just a few classes.
   a) stay close behind other students
   b) find yourself far behind other students
   c) get ahead of other students
2. She seemed to just breeze through the exams. Everyone else was in such a panic and almost had nervous breakdowns.
   a) do them calmly and efficiently
   b) not take them seriously
   c) cheat in them
3. I just can't seem to get the hang of English prepositions. Just when I think I've learnt them I make new mistakes.
   a) memorise b) understand c) enjoy
4. When I sat down and looked at the exam paper my mind just went blank. Everyone else seemed to be writing away quite happily.
   a) became confused b) became very focused c) became empty

7. Read the poem.
Each of us must climb our separate mountain
written by William Byrd

Each of us must climb our separate mountain
To reach at last our own extended view.
We can be no more than what we are,
Yet that is quite enough for us to do.

And so we're proud of each of you today
For all you've learned, and all you've tried to learn.
Knowledge brings the deepest satisfaction,
Not least because it's something that you earn.

Now answer the following questions.

1. What occasion could the poem be referring to?
2. Who could these words be spoken by?
3. Who would this poem be directed to?

8. Check your grammar.
Do you remember?

a) Suggestion and Advice	***had better (’d better)*** ***should*** ***ought to***

Note: Combines suggestion and advice. Conveys the idea ***it would be advisable or right to***.

Example: *You**’d better (should/ought to)** spend more time revising if you want to pass the exam.*

1. I think we should leave at once or we’ll be late.
2. If I were you, I would study harder.
3. I suggest listening to our parents’ advice.
4. I shouldn’t believe a word he says if I were you.
5. Working at the computer all the time is bad for you. You should get some rest.

b) Advice	***worth +… ing***

Example: It’s ***worth learning*** languages.

1. Don’t worry about her. She’s not worth it.
   She’s not …
   or It’s not worth …
2. Pharmacy is a very interesting branch of medical science. You should study it.
3. Remember to take some notes with you. It could be useful.
4. The book is exciting to read.
5. It makes no sense to talk about it. We can’t solve it anyway.

9. Let’s laugh a little!
I will do anything to pass.

A student comes to a young professor’s office hours. She glances down the hall, closes his door, kneels pleadingly.
“I would do anything to pass this exam.” She leans closer to him, flips back her hair, gazes meaningfully into his eyes. “I mean ...” she whispers,“... I would do ... anything.”
He returns her gaze. “Anything?”
“Anything.”
His voice softens. “Anything??”
“Absolutely anything.”
His voice turns to a whisper. “Would you ... study?”

10. Translate.

1. Studijní program Farmacie je magisterské pětileté studium, zakončené státní závěrečnou zkouškou a obhajobou diplomové práce.

2. Výuka každého povinného nebo volně volitelného předmětu je uzavřena na konci semestru zápočtem nebo zápočtem a zkouškou, případně jen zkouškou.
3. Předmět může být uskutečňován v podobě přednášky, cvičení, semináře, kurzu, praxe, stáže, laboratorní práce, exkurze, samostatné práce nebo konzultace.
4. Laboratorní cvičení a praktika tvoří přibližně dvě třetiny studijního programu, zbytek připadá na přednášky a semináře.
5. Lékárník musí mít důkladné znalosti o všech lécích a měl by být schopen pacientům vše potřebné podrobně vysvětlit.
6. Farmaceut by měl umět alespoň jeden světový jazyk, aby mohl sledovat zahraniční odbornou literaturu.
7. Očekává se, že vystudovaní farmaceuti budou i nadále číst vědecké časopisy a účastnit se dalších vzdělávacích programů.
8. Absolvent se může také ucházet o přijetí do tříleté prezenční formy nebo obvykle pětileté kombinované formy doktorského studia.
9. Doktorské studium končí vypracováním a obhájením disertační práce, vykonáním státní doktorské zkoušky a udělením titulu doktor (Ph.D.).
10. Vysokoškolsky vzdělaný farmaceut má znalosti o léčivech a léčivých přípravcích, o látkách užívaných při jejich přípravě, o účinku léčivých látek, o pravidlech užití léčiv, o působení toxických látek atd.

UNIT 2

CHEMISTRY

Chemistry studies elements, their reactions, and interactions. All matter is created from elements. Therefore, chemistry is also concerned with matter, its structure, composition, and properties. It deals with the ways it is formed and changed.

2.1 Different Types of Matter

• Mixtures

A mixture consists of two or more substances mixed together in variable amounts. It is usually possible to separate the mixture back in to its individual components. Much of the matter we come across in our lives exists in the form of mixtures (e.g. fuels, foods, and drinks) Also, our bodies are very complicated mixtures of many individual substances.

• Chemical Elements

A chemical element is a material composed of only one type of atom that cannot be separated into simpler substances and that singly or in combination constitute all matter. In total, 117 have been observed as of 2007. 94 of these fundamental building blocks occur naturally on the Earth. The rest of the elements have been discovered as products of artificial nuclear reactions. Each element has its own symbol established by international agreement.

The elements are arranged in the ***Periodic Table***, the invention of which is generally attributed to the 19th century Russian chemist **Dimitri Mendeleev**. The layout of the table is based on his observations and reflects the recurring chemical and physical properties of the sixty-six then known elements. It is a very practical tool for organising all the known elements of the universe.

• Chemical Compounds

A compound is a chemically pure substance composed of two or more elements in a constant composition and combination. Researches have isolated, identified and characterised more than 15 million chemical compounds. Among these are some of the most familiar naturally occurring substances, including water, salt, and sugar. Nevertheless, most known compounds have been synthesised by chemists. The composition of a compound, its physical properties (such as boiling point), and chemical reactivity are fixed.

2.2 Atoms and Molecules

It is well-known that elements are comprised of **atoms**. An atom is the smallest indivisible (i.e. cannot be broken down) unit of matter that can exist as an independent entity. Atoms are miniscule objects which are many billions of times smaller than anything we can notice with our eyes. In order to see it we need special devices. Each element is created by its own specific combination of atoms. As it has already been mentioned compounds are composed of the atoms of two or more elements. For instance, the compound carbon dioxide has a ratio of two oxygen atoms for every carbon atom. Its symbolic representation is CO_2. This is an example of a **chemical formula**, which represents the elementary composition of chemical compounds.

Not only carbon dioxide but also millions of other compounds exist in **molecules**. A molecule is a combination of a fixed number of atoms, held together in a certain geometric arrangement. Hence, one molecule of carbon dioxide consists of one carbon atom bound to two oxygen atoms.

2.2.1 Atomic Structure

Despite the fact that an atom is an indivisible entity it has its own structure. However, if we try to break it down into smaller particles, it loses its chemical properties. A nucleus, which consists of particles called protons and neutrons, lies in the centre of every atom. Both particles are large and heavy, with the former being positively charged and the latter electrically neutral. Electrons, which are beyond the nucleus and define the outer boundary of the atom, carry negative electrical charges. They are extremely tiny and very light with about $1/2000^{th}$ the mass of a proton or neutron. If an atom is electrically neutral, the number of electrons equals the number of protons. We call this number the **atomic number**. Each element has its own atomic number. For example, hydrogen equals 1, helium 2 and so on.

2.2.2 Isotopes

Isotopes can be defined as two or more forms of the same element whose atoms have the same number of protons but differ in number of neutrons. That is why the isotopes have different **mass numbers** (the sum of the number of protons and neutrons in an atomic nucleus). Helium exists as helium-3 or He-3 (reflecting the fact that its nucleus contains 2 protons but only 1 neutron) or as helium-4 or He-4 (2 protons and 2 neutrons). These two examples are called isotopes of helium. *Deuterium*, a naturally occurring isotope of hydrogen, is assigned a mass number of 2 because it contains one proton and one neutron. *Tritium*, a third radioactive isotope of hydrogen, has two neutrons and one proton. Therefore, it has a mass number of 3. Tritium does not normally appear in nature. Identifying isotopes we add the mass number after the name or symbol of the element. Thus, tritium is designated as hydrogen-3 or H-3.

2.3 Types of Chemical Bonds

• Covalent Bonds

They result when atoms share one or more pairs of electrons. There are two types of covalent bonds; *polar* and *non-polar*. The latter bonds are formed when electrons are equally distributed between the two atoms. However, the former one arises between two different atoms. The polar covalent bond may cause the electrons to be pulled more toward one atom than the other. The end of the molecule toward which the electrons are pulled is electrically negative compared to the other end.

• Ionic Bonds

Normally, atoms are neutral and have no charge. Nevertheless, in order to gain stability they either lose one or more electrons, thus becoming a positive ion (*cation*), or they gain one or more electrons thus becoming a negative ion (*anion*). When this happens the resulting charged atoms attract each other. That electrical attraction between two oppositely charged ions is referred to as an ionic bond. As the electrons are completely transferred to a second atom they are not shared at all.

• In addition, a **single** (sharing only a pair of electrons), a **double** (sharing two pairs of electrons) or a **triple bond** (sharing three pairs of electrons) can form.

2.4 Water

Thanks to its polarity water is the universal solvent. It boils at 100°C and freezes at 0°C. As it heats and freezes slowly, it remains liquid at the temperature of living beings. Pure water has a neutral pH. Acids cause a higher hydrogen ion concentration and thus lower the pH, whereas bases decrease the hydrogen ion concentration and thus increase its pH.

2.5 Composition of Air

Joseph Priestley, the British chemist, contributed greatly to the study of gases. He is most often credited for his discovery of oxygen, which happened in 1774 (three years before it was independently found by *Carl Scheele*). Priestley found that oxygen forms about one-fifth of air. The other four-fifths of air mostly consist of nitrogen, which was discovered in 1772 by the Scottish physician *Daniel Rutherford*. In 1756 another Scottish man named *Joseph Black* discovered carbon dioxide which also occurs in variable amounts in air. He was a chemist and a doctor.

British chemist *Henry Cavendish* also studied gasses. In 1776 Cavendish discovered hydrogen. In 1781 he demonstrated that air is composed mainly of a mixture of nitrogen and oxygen. Two years later he confirmed that the atmosphere sampled at various locations always has the same composition.

2.6 Biomolecules

Biomolecules are naturally occurring molecules in a living organism. They are composed of carbon and hydrogen as well as nitrogen, oxygen, phosphorus, and sulphur.

• Carbohydrates
Carbohydrates are a large class of organic compounds that include sugars, starches, and celluloses. They serve as the main energy source in the diet of animals. They play major roles in the processes of the immune system, fertilization, blood clotting, and development. They are produced in green plants during photosynthesis.

• Lipids
Lipids include fats, oils, waxes, cholesterol, fat-soluble vitamins, and others. They store energy, act as structural components of cell membranes, and function as important signalling molecules that are lipid messengers which bind to and activate a receptor. Many lipids are indispensable for our lives. However, abnormal levels (e.g. cholesterol) can lead to number of diseases.

• Proteins
Proteins consist of amino acids arranged in a linear chain and connected by peptide bonds. They are involved in the processes within cells. They are enzymes which function as catalysts of biochemical reactions. Also, they play a crucial role in structural and mechanical functions. They are indispensable for cell signalling, immune responses, animals' diet, and so on.

• Nucleic acids
Nucleic acids comprise the chains of nucleotides. The two most common examples are DNA (deoxyribonucleic acid) and RNA (ribonucleic acid). The former stores the genetic information and carries the instructions which are used for construction of other cell components. The latter sends messages between DNA and ribosomes and carries amino acids which are to be used in protein synthesis.

2.7 Reactions and Equations

A **chemical reaction** *is a process whereby substances described as* ***reactants*** *are transformed into different substances called* ***products***. *The process can be represented by an expression called a* ***chemical equation***. [Chemistry in Context, p. 16]

By an international agreement the reactant(s) are to be stated on the left whereas the products should be written on the right:

$$\text{Reactant(s)} \rightarrow \text{Product(s)}$$

An arrow in the middle is a symbol of a chemical change which is commonly read as "*is converted to*" or "*yields*". Therefore we can say that one or more products, which are substantially different from the starting reactant(s), are yielded or converted in a chemical reaction.

An example of a simple reaction can be a combustion during which carbon and oxygen are converted to carbon dioxide. This reaction can be represented either by a *word equation* (1) or by *chemical symbols* and *formulas* (2). The latter one is used more often.

(1) Carbon + Oxygen → Carbon dioxide

(2) $C + O_2 \rightarrow CO_2$

Reading the above equation may sound something like this: *One atom of the element carbon reacts with one molecule of the element oxygen (consisting of two oxygen atoms bonded to each other) to yield one molecule of the compound carbon dioxide (consisting of one carbon atom bonded to two oxygen atoms).* [Chemistry in Context, p. 17]

The equation needs to be balanced. The coefficients must be added before the symbols and formulas (3).

(3) $2\ C + O_2 \rightarrow 2\ CO_2$

Exercises

1. Fill in the appropriate word.

1. Chemistry is the study of …….
2. Much of the matter we encounter in everyday life is in the form of …….
3. ..……. are substances that cannot be broken down into simpler stuff by any chemical means.
4. Dimitri Mendeleev developed the ……. ……..
5. A pure substance made up of two or more elements in a fixed, characteristic composition and combination is a ..……..
6. The smallest unit of an element that can exist as a stable independent entity is an ……..
7. A chemical ……. is a symbolic representation of the elementary composition of chemical compounds.
8. A ..……. is a combination of a fixed number of atoms, held together in a certain geometric arrangement.
9. Isotopes are identified by their ..……. numbers – the sum of the number of protons and the number of neutrons in an atom.
10. Covalent bonds that are formed between two identical atoms are the strongest and are called ..……. covalent bonds because electrons are equally distributed between the two atoms. ..……. covalent bonds are formed between two different atoms.
11. ..……. bonds result when one or more valence electrons from one atom are completely transferred to a second atom.

2. Translate the following chemical groups (families) of the periodic table and assign the correct elements to each one.

Alkali metals:
Alkali earth metals:
Lanthanides (Rare earth elements):
Actinides (Rare earth elements):
Transition metals:

Poor (other) metals:
Metalloids:
Nonmetals:
Halogens (nonmetals):
Noble gases (nonmetals):

3. Find the differences between Czech and English terminology of the elements.

4. Translate the following names of the elements.

vodík	vápník	měď	hliník
olovo	kyslík	síra	draslík
křemík	uhlík	hořčík	železo
dusík	jod	zlato	stříbro

5. Read the names of the following symbols.

Mn, Fe, Os, Ba, Fr, Au, Ag, S, Se, Po, Rn, Yb, No, Es, Hg, Rh, Li, Na, K, Ar, Kr, Cl, O, N, As, Al, Pb, Ag, Cu, I

6. Translate the following information about one of the elements.

General information:

Name, Symbol, Number:	helium, He, 2
Chemical series (group, family):	noble gases
Group, Period:	18, 1
Appearance:	colourless
Atomic mass:	4.002602(2) g/mol
Electron configuration:	$1s^2$
Electrons per shell:	2

Physical properties:

Phase:	gas
Density:	(0°C, 101.325 kPa), 0.1786 g/L
Melting point:	(at 2.5 MPa) 0.95 K (272.2 °C, −458.0 °F)
Boiling point:	4.22 K (–268.93°C, −452.07°F)
Critical point:	5.19 K, 0.227 MPa
Heat of fusion:	0.0138 kJ/mol
Heat of vaporization:	0.0829 kJ/mol
Heat capacity:	(25 °C) 20.786 J/(mol . K)

Helium, chemická značka He, je plynný chemický prvek patřící mezi vzácné plyny a tvořící druhou nejvíce zastoupenou složku vesmírné hmoty.

Jedná se o bezbarvý plyn, bez chuti a zápachu, chemicky zcela inertní – nejsou známy žádné chemické sloučeniny helia. Helium má ze všech známých látek nejnižší bod varu a tání.

Helium při extrémně nízkých teplotách a normálním tlaku zůstává kapalné až k teplotě absolutní nuly. Je supratekuté.

Helium bylo vytvořeno nukleární syntézou ve hvězdách. Tvoří přibližně 25 % hmoty pozorovatelného vesmíru. Na Zemi, kde je hlavně produktem jaderného rozpadu prvků v zemské kůře, se ve větším množství nachází pouze v zemním plynu; jinak je jeho výskyt velmi vzácný.

Vzhledem ke své extrémně nízké hustotě a inertnímu chování se helium používá k plnění balónů a vzduchoplodí jako náhrada hořlavého vodíku, do dýchacích směsí určených pro potápění do velkých hloubek, jako ochranný plyn k mnoha průmyslovým účelům (např. svařování).

7. Water. Can you explain the following facts about water?

a) Water remains liquid at room temperature.
b) Water is the universal solvent.
c) Water is excellent transport medium in human and animal bodies.
d) The temperature of water in a liquid state is not liable to change drastically.
e) Water prevents our bodies from overheating.
f) Ice always floats on water.

8. Do we have enough water supplies? Fill in the correct word derived from the word in bold.

Probably everybody knows that water is indispensable for life on the planet. Many people take water for 1. **GRANT**. However, there is a growing need to change such attitudes. As a result of the extremely large populations currently 2. **LIFE** on our planet a lot of countries are experiencing 3. **SHORT** of water supplies. They have already learnt the fact that water is a 4. **PRECIOUSNESS** thing which ought to be 5. **PROTECTION**. One way how to get more drinking water 6. **SUIT** for animal and human consumption is to use "desalination". It refers to a process by which 7. **EXCESS** amounts of salt and other minerals are removed. Therefore, salt water is converted to 8. **DRINK** fresh water. China, which suffers greatly from inadequate 9. **SUPPLIER** of water, has been using desalination since 1958.

In Europe there is still enough water, however, its quality is decreasing. Will we also experience a lack of water supplies in the near future?

9. Nuclear power.

a) Read the following article.

b) Can you add any other facts concerning nuclear power?

Nuclear power is a technology which applies nuclear reactions, especially nuclear fission, in order to release energy for useful purposes including propulsion, heat, and the generation of electricity. It uses a dangerous element called uranium. It is a metal extracted from rocks, soil, and oceans in various parts of the world.

Sometimes the era we live in is called the *Nuclear Age*. Its commencement dates back to 1945 when the USA tested nuclear weapons. 'The first nuclear power station was opened in England in 1956. The nuclear power accounts for approximately 6.5% of the world's energy and 16% of the world's electricity. The IAEA (International Atomic Energy Agency) reported the existence of 439 active nuclear power reactors in 31 countries. In Europe the biggest number of the nuclear power stations was built in France, on the other hand some countries, such as Austria and Ireland, do not have any in operation.' [wikipedia.org/wiki/Nuclear_power]

Worldwide there has been growing a big political resistance towards the nuclear power. In many countries the research in this field has stopped and the nuclear power stations have been shut down. Nevertheless, many countries remain active in research and development of the nuclear power and weapons.

c) Are you in favour of or against nuclear energy. Prepare a small speech justifying your opinion.
Proponents of nuclear energy claim that:

- It produces huge amounts of energy.
- It does not pollute the air compared to burning fossil fuels.
- The risks of storing nuclear waste are very small.
- The operation of the nuclear power plants is safe.
- In future there will be a shortage of electricity unless we continue to use the nuclear power.
- Heavy metal emissions from fossil fuels contribute to global warming.
- Fossil fuels' prices are rising.
- .....

Critics of nuclear energy think that:

- It is uneconomic and potentially dangerous energy.
- We cannot be sure whether the costs and risks can be reduced using some new technologies.
- There is a danger of possible radioactive contamination due to some accident. People have not forgotten Černobyl!
- A potential danger of nuclear proliferation is too high.
- It is a risk to the environment and to humanity which must not be taken.
- To store nuclear waste is too risky.
- Building a sufficient number of nuclear power stations to significantly reduce the greenhouse gas emissions would cost billions of dollars. It would produce massive amounts of high-level radioactive waste.
- The nuclear power stations are excellent targets for terrorist attacks.
- The USA, Russia, France, the UK and China (and maybe some other countries) posses dangerous nuclear weapons. Anyway, any country that owns a nuclear power station is a potential nuclear weapon producer.
- .....

10. Greatest inventions.

a) Discuss:

1. How does science affect our everyday lives?
2. What can scientists do to make science more understandable to public?
3. Do you think it is a good idea to popularize science?

b) Think of the greatest inventions that changed our lives throughout the history. Write as many as you can.

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c) Descriptive language.
Describe the use of some of the inventions that you have come up with.
Use the words like: *machine, equipment, tool, instrument, thing, device and so on.*
Say what it is used for.
Do not forget to describe its *shape, size, material, and purpose*.

Example: *A **television** is a device which has a rectangular or square shape and a screen in front. It receives electrical signals and turns them into moving images and sound over a distance. It is quite common to have one or two TV sets in every household. It is used for entertainment and education.*

d) Game. Saving the greatest inventions.

Imagine that the world is going to collapse. There is a way how to save some of the greatest inventions and take them to another planet which has been discovered in an attempt to save the mankind and some of the best things that have ever been created. A special space shuttle has been invented in order to carry the inventions. Regrettably, only a few healthy man and women have been honoured to travel in the shuttle. They are to start a new generation and preserve the greatest inventions. However, there is one big problem troubling them right now. Because of limited space in the shuttle there is no way that all the inventions can fit in.

Work in pairs and choose one invention that you like. Your task is to discuss all the advantages that in your opinion could contribute to the new life on another planet. Prepare your arguments carefully because you ought to persuade your schoolmates that your invention is the best. Your motivation is that you can "survive" together with your invention. At the end everybody will have to decide who shall be taken and who shall be left behind.

11. Check your grammar. Active and passive.

Rewrite the following sentences, replacing the active form in italics by the passive form.

Examples: *Fibre **is removed** in the production of white flour.*
*Further studies of this problem **are being carried out**.*
*Many similar claims **have been made**.*
*A new drug **was developed**.*

1. A group of Japanese surgeons *are performing* the operation.
2. Watson and Crick *had proposed* the double-helix model of DNA before Pauling *described* the alpha-helix of giant protein molecules.
3. They *discovered* the layout of bases, sugars, and phosphates within the molecule during the 1930s and 1940s.
4. You *can split* the atom into smaller particles such as protons, electrons, and neutrons.
5. You *may ascertain* the presence of obesity from an examination of the patient, but you *need* a weighing machine or scales to measure their weight accurately.
6. The surgeon *x-rayed* my lungs yesterday and I wonder why he *has x-rayed* my lungs today again.