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*Приложение 2*

**МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ**
**федеральное государственное бюджетное образовательное учреждение высшего образования**
**«Пермская государственная фармацевтическая академия»**
**Министерства здравоохранения Российской Федерации**

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КАФЕДРА ИНОСТРАННЫХ ЯЗЫКОВ
*Полное наименование кафедры*

УТВЕРЖДЕНЫ
решением кафедры
иностранных языков
Протокол от «___6_» __июня__ 2024 г. №__10_

# МЕТОДИЧЕСКИЕ МАТЕРИАЛЫ ПО ДИСЦИПЛИНЕ

## СГ.02. Иностранный язык в профессиональной деятельности

*Индекс и полное наименование дисциплины*

18.01.34 Лаборант по контролю качества сырья, реактивов, промежуточных продуктов, готовой продукции, отходов производства (по отраслям)
*(код, наименование профессии)*

**Год набора: 2025**

Пермь, 2024 г.

***1. Рекомендации по подготовке к практическим занятиям.***

Обучающимся следует:

- приносить с собой рекомендованную преподавателем литературу к конкретному занятию;
- до очередного практического занятия по рекомендованным литературным источникам проработать теоретический материал соответствующей темы занятия и отработать задания, определенные для подготовки к лабораторному занятию;
- при подготовке к практическим занятиям следует использовать учебную литературу;
- в начале занятий задать преподавателю вопросы по материалу, вызвавшему затруднения в его понимании.
- в ходе практического занятия давать конкретные, четкие ответы по существу вопросов.

## Вопросы для самопроверки

### Раздел 1. Обучение в Фармацевтической академии.

### Вопросы для самопроверки по теме 1.1. «Семья и друзья»

1. What can you tell us about your family?
2. What term are you with your family in?
3. When and where did you finish school?
4. What was (were) your favorite subject(s) at school?
5. How many years did you study English at school?
6. When and why did you decide to choose a career of a pharmacist?
7. Who advise you to be a pharmacist?
8. Have you got brothers and sisters?
9. How many brothers and sisters have you got?
10. What are their names?
12. How old are they?
13. What term are you with your family in?
14. When and where did you finish school?

### Вопросы для самопроверки по теме 1.2. «Рабочий день»

1. Do you plan your working day?
2. When do you get up?
3. What do you do in the morning?
4. What do you have for breakfast?
5. When does your working day begin?
6. How many pairs do you have a day?
7. How long does your working day last?
8. When do you leave academy?
9. How do you feel yourself after leaving academy?
10. Do you take part in out-of class activities?
11. What do you do in your spare time?
12. When is your working day over?
13. When do you go to bed?
14. What do you do in your spare time?

### Вопросы для самопроверки по теме 1.3. «Академия: прошлое и настоящее»

1. What academy do you study at?
2. What course are you in?
3. When was the pharmaceutical Institute founded?
4. When was the pharmaceutical Institute reorganized into academy?
5. How many departments does our academy have? What are they?
6. How long does the course of training run?
7. What can you tell about the history of our academy?
8. How many departments does our academy have? What are they?
9. What subjects do the students study?
10. Where do the students live?
11. Do you take part in out-of class activities?
12. What specialties do the students get after graduating from the academy?
13. Where may the students work after graduating from the academy?

## Раздел 2. Химический элемент: химия и периодическая система Д. И. Менделеева

### Вопросы для самопроверки по теме 2.1. «Химия как наука»

1. What is chemistry?
2. What is chemistry concerned with?
3. What physical and chemical properties do you know?
4. How many states of aggregation does matter have? What are they?
5. How does temperature influence the substance?
6. How are chemical products used in everyday life?
7. What main aspects does chemistry have?
8. What are the main divisions of chemistry?
9. What do organic and inorganic chemistries deal with?
10. What is the importance of chemistry?
11. What are the categories of chemistry?
12. How are the substances divided?
13. What kinds of chemistry are taught at our Academy?
14. What does organic chemistry study?

### Вопросы для самопроверки по теме 2.2. «Кислород. Водород»

1. What is the chemical symbol of oxygen, its atomic weight?
2. What can you say about the oxygen molecule?
3. What are the properties of oxygen?
4. What is the reaction of oxidation?
5. Where is oxygen found?
6. Why is oxygen very important?
7. How is oxygen produced?
8. Where is oxygen used?
9. What is the chemical symbol of hydrogen, its atomic weight?
10. What can you say about the hydrogen molecule?
11. What are the properties of hydrogen?
12. Is it easy to liquefy hydrogen?

13. What can you say about liquid hydrogen?
14. What elements does hydrogen react with at ordinary temperatures?
15. Where does hydrogen occur?
16. Where is hydrogen applied?

### Вопросы для самопроверки по теме 2.3. «Химический элемент (на выбор обучающегося)»

1. Why have you chose this element?
2. What is the history of the element‘s discovery?
3. Where has the element came from?
4. What is the symbol of the element?
5. What are the physical properties of the element?
6. What are the chemical properties of the element?
7. What are the typical chemical reactions of the element?
8. How can you distinguish the presence of that element?
9. Characterize the place of the element in the Periodic Table?
10. What is the practical importance of the element?
11. How is the element used in medicine?
12. What data about the element are worth mentioning?
13. Is the element of vital importance? Prove.

## Раздел 3. Химическая лаборатория

### Вопросы для самопроверки по теме 3.1. «Химическая лаборатория: оборудование»

1. Where is the chemical laboratory you make experiments situated?
2. What is a chemical laboratory?
3. How many rooms does the chemical laboratory consist of?
4. What are these rooms for?
5. What are they equipped with?
6. Where do the students carry out chemical experiments?
7. How many rooms does the chemical laboratory consist of?
8. What are these rooms for?
9. What are they equipped with?

### Вопросы для самопроверки по теме 3.2. «Правила работы в лаборатории»

1. Do the students work in white gowns and hats in the laboratory?
2. What does the work in the chemical laboratory require?
3. What chemical processes will you deal with?
4. How do the students work with substances and reagents?
5. Why are the rules so important?
6. What are the rules for working at the lab?
7. Is it necessary to be accurate?

### Вопросы для самопроверки по теме 3.3. «Документация в химической лаборатории»

1. Why is documentation vital when working with analytical reagents?
2. What types of documents are important for laboratory technician?
3. What are the main requirements for reagents used in analytical laboratory?

4. What information can be found in reagent passport and quality certificate?
5. What documents and records are necessary to have for any laboratory equipment?
6. What information should be available in a file for each instrument used?

## Раздел 4. Моя будущая профессия

### Вопросы для самопроверки по теме 4.1. «Лаборант по контролю качества: основные обязанности»

1. What is your future profession?
2. Why have you decided to become a QC lab assistant?
3. What is a QC lab assistant job description?
4. What are the possibilities of your future career path?
5. Where can you work after graduating from the Academy?
6. What functions does the work of a QC lab assistant include?
7. What can you say about working conditions of a QC lab assistant?
8. What is the working place of a QC lab assistant equipped with?

### Вопросы для самопроверки по теме 4.2. «Лаборант по контролю качества: перспективы профессии»

1. What is the role of a quality control assistant?
2. What are the duties of a quality control assistant?
3. How many types of quality control are there in a laboratory?
4. What should specialist do for staying on top of what is happening in the field?
5. Why are quality control assistants needed?
6. What skills should a good quality control technician have?
7. What are your priorities?

***2. Рекомендации по подготовке к собеседованию.***

Собеседование можно отнести к многоплановой форме контроля, в ходе которой осуществляется проверка сформированности не только коммуникативной, но и лингвокультурологической компетенции. В ходе собеседования проверяется умение обучающегося создавать монологические высказывания на разные темы с соблюдением языковых норм (орфоэпических, лексических, грамматических, стилистических), а также принимать участие в диалоге. Обучающиеся должны владеть коммуникативно-речевой стратегией, помогающей не теряться в ситуации непосредственного общения, и создавать ситуативно уместные, достаточно спонтанные речевые устные высказывания, которые требуются по условиям определенного учебного задания.

В практической деятельности по подготовке обучающихся к собеседованию необходимо обратить особое внимание на обучение пересказу текстов по изучаемым темам. В процессе «говорения» обучающийся должен показать степень владения всеми коммуникативно-речевыми формами речи (повествование, описание, рассуждение), а также монологического высказывания и диалогического общения. Необходимо обращать внимание обучающихся на то, что некоторые задания опираются на их личный жизненный и учебный опыт и результат собеседования зависит также от него.

Рекомендуемая последовательность подготовки к монологическому высказыванию:

- прочитать текст и сделать необходимые пометы, например, проставить ударение в словах, объяснить значение слов;
- выделить ключевые слова и слова, вызывающие трудности при прочтении;
- сформулировать основную мысль каждого абзаца и всего текста;
- выделить главную и второстепенную информацию каждого смыслового фрагмента;
- составить план пересказа;
- пересказать текст.

По окончании монологического высказывания обучающемуся задаётся несколько вопросов по теме. Вопросы подобраны таким образом, что помогают расширить и разнообразить содержательный и языковой аспект речи обучающегося, стимулировать его к использованию новых форм речи и расширению активного словарного запаса. Это обеспечивает естественный переход от монолога к диалогу с собеседником. Цель экзаменатора-собеседника – эмоционально расположить экзаменуемого к беседе, стимулировать его речевую деятельность. Диалог оценивается в целом по всем ответам обучающегося на вопросы; учитывается речевая ситуация.

**Тексты для собеседования по темам раздела 1. Обучение в фармацевтической академии.**

### Text 1

I should say it is not easy to be a student of the Perm Academy of Pharmacy. We have classes 6 days a week. My working day begins at 7 o'clock in the morning. You know, I'm not an early riser but my alarm-clock rings and there is nothing to be done as to get up and start my new working day.

Usually I do my physical jerks, go to the bathroom, wash myself, clean my teeth and brush myself. It takes me 10 minutes to do my bed and dress myself. Then I go to the kitchen to have my breakfast. It may be a cup of tea or coffee and some sandwiches.

After my morning meal I leave for the Academy at 8.30 or at 9 o'clock in the morning. We have three or four pairs a day. There is a 30-minutes break before the last pair. Our classes are usually over at 3 o'clock in the afternoon. But sometimes I do not leave the Academy after classes because of my out-of-class activities. So I have dinner either at home or at the canteen. When at home I usually have something substantial for dinner, for example, cabbage soup for the first course, hot meat or fish with some vegetables for the second one and a glass of juice for dessert.

As a rule 1 have no spare time on my week-days. I usually spend much time to do my homework. Sometimes I have to go to the library either to get ready for my practical classes or to write a report. Sometimes I have to sit up either to write a composition or to translate a text from English into Russian.

As you remember, eight o'clock is supper time in our family. We all get together in the kitchen to have our evening meal and to discuss different problems.

After that I prefer to do a little reading. Sometimes I either watch TV or listen to the music. And every evening I do my best to find time for my computer.

It is until midnight that I usually go to bed. So by the end of the week I get tired and need a good rest. Sunday is the only day I can get up later and stay at home the whole day. It’s my best day in a week.

### Text 2

The pharmaceutical education in the Urals is connected with the foundation of Perm State University. The experience of WWI showed that there was practically no pharmaceutical industry in the country and it needed the specialists in pharmacy a lot. So, on the initiative of Nikolay Ivanovich Kromer, the famous Russian scientist, the Master of Pharmacy, the pharmaceutical department at Perm State University was founded in 1918. It gave a birth to the high pharmaceutical education in the Urals. Later the pharmaceutical department got the status of the pharmaceutical faculty. In 1937 it became an independent Pharmaceutical Institute. In 1955 the extra-mural department was established. In 1992 the

Institute started educating foreign students from different countries of Africa, Asia and the East. One more page in the history of the Institute is the fact that it was reorganized into Academy in 1995.

About 4000 students both Russian and foreign study at the Academy. Some of them attend the day department and others study by correspondence at the extra-mural department. Moreover, there are more than 200 interns and 50 postgraduate students at the academy. For those who are going to enter the Academy the preparatory courses are organized.

The course of training the day department students runs for 5 and of the extra-mural department students for 5.5 years. During this period the students study general and special subjects. General subjects are English, Maths, History, Physical Education, etc. Special ones are different branches of Chemistry, Botany, Pharmacology, Pharmacognosy, etc. Besides, the students have practice in the fields, at the chemist's shops and pharmaceutical factories. Moreover, the students can take part in different students' conferences and contests, and play sports in sport clubs. Those students who study well and take part in social work get grants. On graduating from the Academy the students get the profession of a pharmacist and can work or continue their education at postgraduate courses, which takes for 3 more years. The graduates of the academy can work at chemist's shops, pharmaceutical factories, firms, companies and at pharmaceutical academies.

## Text 3

Perm Pharmaceutical Academy occupies three buildings, a scientific research centre "Pharmatest", 2 hostels and a botanic garden. The main or the administrative building is in 2, Polevaya street. It is a modern four-storied building. There are rector's and dean's offices, an account department, a personnel department and 2 chairs: the chair of pharmacognosy with the course of botany and the chair of management and economy of pharmacy. Besides, there are many classrooms, a large lecture hall and a canteen. Moreover, there is a museum of pharmacy and history of the Academy.

The laboratory building in 46, Krupskaya street was built many years ago. It is a typical laboratory building. There are 10 chairs in it: the chair of general and organic chemistry, the chair of pharmaceutical chemistry at the day department, the chair of pharmaceutical chemistry at the advanced training faculty for pharmacists and at the extra-mural department, the chair of biological chemistry, the chair of analytical chemistry, the chair of physical education, the chair of pharmaceutical technology, the chair of physiology, the chair of pharmacology and the chair of industrial technology of medicines with a course of biotechnology. On the ground floor of the building there is a library and a reading room where the students can prepare for their seminars and practical work, a large gym where the students can play sports and a canteen. Two large lecture halls, many classrooms and laboratories supplied with necessary equipment are also housed in this building. Experienced teachers from different chairs conduct classes and seminars in those classrooms and laboratories.

Next to the laboratory building you can see a scientific research centre "Pharmatest" with the chair of toxicological chemistry.

The theoretical building, situated in 81, Gagarin Avenue, is a five-storied one. There are seven chairs in the theoretical building. They are: the chair of organization, economy and history of pharmacy, the chair of microbiology, the chair of humanities and social and economic disciplines, the chair of extreme medicine and medical goods, the chair of foreign languages, the chair of physics and mathematics and the chair of Latin and pharmaceutical terminology. Besides, there are many classrooms, a dental clinic and a café in this building.

Most students of our academy live in its two hostels and only some rent rooms. Hostel №1 in 72a, Gagarin Avenue is a modern, 9-storied building with central heating, hot and cold water, shower cabins, baths, a refuse chute, an elevator, electric cookers and sinks in the kitchens. Moreover, there is a reading hall, a student's club and a canteen.

Hostel № 2 in 101, Ekaterininskaya street is an old 5-storied building with a lot of rooms for students to live in. Besides, there is a health centre, a library, an Internet and other clubs.

## Text 4

Perm Pharmaceutical Academy has more than 200 professors and teachers at 20 chairs which carry out academic, scientific and research work at its three buildings, a scientific research centre "Pharmatest" and a botanical garden. Lectures are given in the lecture halls, practical classes are held in the classrooms and laboratory classes – in the scientific laboratories.

The Academy has a botanical garden where the students have practice cultivating, collecting and studying different medicinal herbs.

Besides, the students of our Academy take part in scientific work making experiments in its many labs and a scientific research centre "Pharmatest". They attend 20 Students' scientific societies of the Academy. The results and achievements of scientific and research work are written down in scientific articles and reported at scientific students' and teachers' conferences.

There are also many extra-curricular activities at Perm Pharmaceutical Academy. They are the sports' club, the students' club and the students' trade-union organization.

The students who like sports can attend the sports' club and play volleyball, basketball, football or do aerobics, athletics and powerlifting. They take part in different matches and competitions.

The students' club organizes different cultural events: contests, concerts, shows and festivals. The students who attend it sing, dance and do dramatizations.

The students' trade-union organization protects social and economic rights and interests of the academy students.

## Text 5

Nikolay Ivanovich Kromer (real name – Johann Napoleon Kromer) is a Russian and Soviet pharmacist, chemist, the founder of pharmaceutical education in the Urals and Siberia was born on the 31of October in 1866 in Mitava Kurland province in the family of an apprentice typographer.

After finishing school and then the Derpt University he worked there as the laboratory assistant. In 1891 he went abroad on a year scientific commission to England. He carried out extensive research and scientific work, became a Master of Pharmacy and delivered lectures on analytical and organic chemistries. He worked in Petersburg, Kazan, Voronezh and Moscow as a leading toxicologist.

In 1917 he was sent to the Perm State University as the professor of the chair of pharmacy and pharmacognozy. In April 1918 on the initiative of N.I. Kromer the pharmaceutical department was opened. The first of August is considered to be the date of the beginning of the pharmaceutical education in the Urals.

The main academic subjects were pharmaceutical chemistry, pharmacognozy, technology of making medicines and there were additional courses such as pharmaceutical law, forensic chemistry, and chemistry of food products. Thanks to Kromer's energy and persistence the chairs and laboratories were supplied with German equipment and were the best in the country. A garden of medicinal plants was laid at that time. In 1920 a model pharmacy was established on the basis of this pharmaceutical department.

Knowing the requirements of the practical pharmacy in the Urals and Siberia N.I. Kromer organized the advanced training courses for pharmacists and took an active part in the establishing of the first pharmaceutical school.

He published 118 scientific works among them 18 in co-authorship with students. For some time he worked at the Medical Institute at the chemical and pharmaceutical department. While organizing an independent Perm Pharmaceutical Institute in 1937 he was the chairman of the Committee making up an academic programme and worked much as the head of the chair of inorganic and analytical chemistries and the chair of pharmaceutical and forensic chemistries.

The name of the outstanding scientist and chemist, a Master of Pharmacy, Doctor of Chemical sciences, Professor N.I. Kromer is known to all the pharmaceutical publicity.

N.I. Kromer died in August 1941and was buried in Egoshihinsky cemetery in Perm.

**Тексты для собеседования по теме 2.1. «Химия как наука» раздела 2. Химический элемент: химия и периодическая система Д. И. Менделеева.**

## Text 1

Chemistry is the science which deals with materials, their properties and the transformations they undergo. So, chemistry is the study of the composition and properties of matter, both physical and chemical changes, the conditions un-der which such changes take place, and the energy changes that accompany them. Chemistry is concerned with different natural phenomena.

Every substance has physical and chemical properties. Physical properties include colour, odour, solubility, density, hardness, boiling and melting points. Chemical properties include reactions with other materials.

Matter exists in three states: the solid, the liquid and the gaseous states. A substance can be transformed from one state into another under the changes of its temperature.

Chemical products are widely used in everyday life. Metals, glass, plastics, dyes, drugs, paper, soap, explosives and perfumes are all made of chemicals. All this is used in national economy.

Chemistry has two main aspects: descriptive chemistry (the discovery of chemical facts) and theoretical chemistry (the formulation of theories).

The broad field of chemistry may also be divided in other ways. An important division of chemistry is that into the branches of organic chemistry and inorganic chemistry.

Organic chemistry is the chemistry of the compounds of carbon that occur in plants and animals.

Inorganic chemistry is the chemistry of the compounds of elements other than carbon. Each of these branches of chemistry is in part descriptive and in part theoretical.

Everyone understands the importance of chemistry. The future of chemistry is practically unlimited. Rapid development of chemical industry will make it possible to create many new goods: machines; plastics, polymers, it will help to understand many new phenomena.

## Text 2

Dmitry Ivanovitch Mendeleyev, the great Russian scientist, the father of the Periodic Law and of the Periodic Table of Elements, was born in Tobolsk in 1834 in the family of the director of the town Gymnasium.

He received a secondary education at the Tobolsk Gymnasium. He studied very hard, he especially liked mathematics, physics and history. At the age of 16 he finished gymnasium and went to Petersburg where he entered the physico-mathematical department of Pedagogical Institute and graduated from it with a gold medal in 1855.

After graduation Mendeleyev worked as a teacher of chemistry for two years, first at the Simferopol and then Odessa Gymnasiums. In 1859 Mendeleyev received his Master's degree and went abroad on a two-year scientific commis-sion. In 1860 he took part in the World Chemical Congress in Karlsruhe.

When Mendeleyev returned to Russia he was elected the professor of the Petersburg Technological Institute. In 1865 Mendeleyev was granted the Doctor of Science degree for the thesis on the combination of alcohol with water. This work was both of great theoretical and practical significance.

Soon after that D.I. Mendeleyev was appointed the Professor of St. Petersburg University where he carried out his scientific and pedagogical ac-tivities for twenty-three years, teaching chemistry. His lectures were always inter-esting and the students of that time listened to them with great interest and atten-tion. Besides lectures Mendeleyev made a lot of experiments in his laboratory. He wrote down the results of his experiments and later grouped all those data.

Mendeleyev described more than 60 elements, which were known at that time and found that all the elements could be divided into nine groups. Each of these groups may be divided into five series. The elements of one group possess more or less similar properties. In 1869 Mendeleyev published his Periodic Table of Elements which began a new era in chemical thought.

Mendeleyev also paid much attention to many subjects. He was the first to put forward the idea of studying the upper layers of the atmosphere. His numer-ous works dealt with many subjects: properties of liquids, theory of solutions, the development of the gas law, the use of oil and many others.

In 1893 Mendeleyev was appointed the Director of the Bureau of Weights and Measures. He was elected the member of many academies abroad. D. I. Men-deleyev continued his research work to the very last day of his life. In February 1907 at the age of 73 Mendeleyev died of pneumonia.

Mendeleyev always combined theory and practice. He gave a great deal of attention throughout his life to the development of the industry of his country. He wrote: “Science and industry – there lie my dreams!”. The world is thankful to Mendeleyev for his great contribution to the world science.

**Тексты для собеседования по теме 3.2. «Правила работы в лаборатории» раздела 3 Химическая лаборатория.**

## Text 1

A chemical laboratory is equipped with different apparatuses and instruments: microscopes, analytical balances, distillators for obtaining distilled water as the running water contains various imputes, burners to heat solutions and thermometers, burners.

The simplest and the most common of all is a liquid thermometer. Mercury is a particularly suitable liquid because of its high boiling and low solidifying points. Thermometers are supplied with a scale. The Centigrade scale is universally used in scientific work.

The apparatuses necessary for carrying out experiments are clamped to ring-stands. There is a special room for weighing which is equipped with a set of balances for different use. The windows of the weighing-room should overlook the North as the sun may prevent accurate weighing of the substances.

On the shelves and racks besides empty vessels there are many bottles and boxes with chemical substances called reagents. The most widely used reagents which are available at every laboratory are: acids (nitric, sulphuric, hydrochloric); alkalis (ammonium solution, potassium solution, sodium solution); oxides, inorganic salts, indicators (e.g. phenolphthalein).

Reagents which are used in large amounts are supplied in big boxes or bottles. Reagents which are seldom used are supplied in amounts up to 10 or 1g or even less.

The work in the chemical laboratory requires also the use of solvents. The most universally used solvent is water. It is the best solvent for most inorganic salts and in addition it dissolves many organic compounds. Alcohol is the next most useful solvent.

When students come to work to the laboratory they should put on white gowns and wash their hands thoroughly with running water before work and after it.

## Text 2

There are two major concerns to be considered when working in a biochemistry laboratory. First is safety: this can never be overemphasized. The second is efficiency in the laboratory work. Although the latter very much depends on the individuals doing the experiments, there are general rules students are advised to follow:

1. keep the benches and shelves clean and well-organized;
2. avoid contaminating the chemicals; use only clean glassware and spatulas; label glassware in use;
3. plan your experiments before starting to carry them out;
4. pay attention to others in the laboratory.

Students working in a biochemistry laboratory must always be aware that the chemicals used are potentially toxic, irritating and flammable. Such chemicals are hazards, however, only when they are mishandled.

Do not work alone in the laboratory. Eating, drinking and smoking in the laboratory are strictly prohibited. Special care for eye protection is required. Safety glasses must be used when certain procedures are being carried out. The instructor will call the students' attention to those procedures.

While heating a solution one should make sure not to overheat it; therefore, vigorous mixing of the solution by shaking or stirring is required. The mouth of the glassware containing the solution to be heated should never be pointed toward anyone.

Handling of strong acids and bases requires special attention. When diluting concentrated acids, the acid should be poured into the water and never the opposite.

The pipettes should never be filled with solutions of toxic substances, biological fluids, strong acids and bases by mouth suction. Volatile liquids and solids that are toxic or irritating should be handled under fume hoods.

While handling flammable liquids such as ether, alcohols, benzene, naked flame (burners, matches) must not be in use. The above liquids must not be stored near radiating heat sources, such as the laboratory oven.

Before using electrical appliances, make sure they are grounded. Flasks with flat-bottoms or thin walls should not be desiccated. Before leaving the laboratory, electrical equipment should be turned off, and gas burners extinguished. No tap water should be left running.

## Тексты для собеседования по темам раздела 4 «Моя будущая профессия».

## Text 1

A QC Technician is responsible for supporting all laboratory activities. They play a part in ensuring that the quality of raw materials and consumables used are fit for purpose and will not cause harm to patients. As a QC Technician, you will be required to work under the supervision and instruction of a QC Scientist.

A quality control technician ensures that products and services meet specified quality standards. They use various techniques to inspect and test products, such as measuring dimensions, examining materials, and analyzing data. Quality control technicians also maintain records of their findings and work closely with production teams to identify and resolve any issues. They may use specialized software to track quality metrics and report on trends over time.

It typically takes 2-3 years to become a quality control technician. I obtain this education here, at Perm State Pharmaceutical academy. A chemical laboratory technician needs a variety of hard skills to succeed in their role. These include lab equipment, routine maintenance, chemical analysis, and analytical methods.

Lab equipment refers to tools and machines used in laboratory settings to conduct experiments and analyze data. Chemical laboratory technicians use lab equipment such as ph meters, titrators, and refractometers to test products. They also perform preventative maintenance and repairs on broken equipment to reduce downtime. They calibrate and maintain the equipment to ensure that it's working properly and efficiently. Routine maintenance is the regular upkeep and repair of equipment and systems to ensure they are functioning properly. Chemical analysis is the process of testing substances to identify their chemical composition. Chemical laboratory technicians use chemical analysis to check the quality of raw materials and finished products. They perform tests and maintain lab equipment to ensure the accuracy of their results. As a chemical laboratory technician, you might conduct experiments and use various methods to analyze substances, like spectroscopy and atomic absorption.

In addition to hard skills, soft skills are also important for a chemical laboratory technician. These include being a team person, treating others right, and working hard.

To be a high-qualified chemical laboratory technician is my dream.

## Text 2

Chemical technicians perform chemical sampling and analysis and are involved in a variety of projects, for example analytical testing, quality control protocols, and product research and development. They often work as members of multidisciplinary teams with chemists, chemical engineers, and other related professions. Chemical technicians can specialize in a number of disciplines, including environmental testing, mining and exploration, pharmaceuticals, and hazard waste, and opportunities for technicians can be very diverse depending on the industry and their education.

The role of a chemical technician is to conduct analytical or lab-based tests on a variety of chemicals, materials or products. They typically receive samples and conduct testing for the purposes of quality assurance, safety inspection, regulatory adherence, environmental impact or sample testing.

This profession is an ideal career path for those who enjoy scientific study and prefer to work with their hands in a laboratory environment. Furthermore, depending on their employer, many chemical technologists are able to provide vital information through their testing and make a significant impact on people's lives.

Chemical technicians are involved in quality control testing, environmental analysis, product R&D and more. They could work in a variety of settings – industrial plants to commercial and government labs. The mining and resource sectors are big employers, but they will also find opportunities in agriculture, food and manufacturing. Key industries are rubber, plastics and chemical products. These industries are strongly affected by foreign markets.

Such professionals should have knowledge and skills in:

- analytical instrumentation
- basic, organic, physical, analytical and environmental chemistry
- handling and manipulating chemicals
- laboratory quality control and assurance
- recording, processing and reporting data.

Among the greatest challenges for chemical technicians is keeping up with rapid changes in equipment and technology. Furthermore, some employers may require more specialized training in a particular field such as water sanitation, food processing or pharmaceutical production technology.

Language skills are vitally important. Besides, computer knowledge is commonly required for this profession because computerized equipment is used for chemical testing and analysis.

Chemical technology is a popular and developing sphere with a lot of career and job opportunities in different industries. With many exciting discoveries to make and new problems to solve, chemical technology professionals can make a difference in the lives of others in many ways.

## Text 3

Chemical technicians are known to conduct chemical and physical laboratory tests. They should assist scientists in making qualitative and quantitative analyses of solids, liquids, and gaseous materials for research and development of new products or processes. They are also responsible for quality control, maintenance of environmental standards, and other work involving experimental, theoretical, or practical application of chemistry and related sciences.

Chemical technicians provide and maintain a safe work environment by participating in safety programs, committees, or teams and by conducting laboratory or plant safety audits.

They maintain, clean, or sterilize laboratory instruments or equipment, compile and interpret results of tests and analyses.

They also conduct chemical or physical laboratory tests to assist scientists in making qualitative or quantitative analyses of solids, liquids, or gaseous materials.

Chemical technicians provide technical support or assistance to chemists or engineers. What is more, they order and inventory materials to maintain supplies. They write technical reports or prepare graphs or charts to document experimental results, monitor product quality to ensure compliance with standards and specifications.

Besides, they train new employees on topics such as the proper operation of laboratory equipment, prepare chemical solutions for products or processes, following standardized formulas, or create experimental formulas.

Chemical technicians set up and conduct chemical experiments, tests, and analyses, using techniques such as chromatography, spectroscopy, physical or chemical separation techniques, or microscopy. They develop or conduct programs of sampling and analysis to maintain quality standards of raw materials, chemical intermediates, or products. They also design or fabricate experimental apparatus to develop new products or processes.

Additionally, chemical technicians operate experimental pilot plants, assisting with experimental design. They develop new chemical engineering processes or production techniques and direct or monitor other workers producing chemical products.

Educational requirements for quality control laboratory technicians vary, but most employers prefer some college coursework.

## Text 4

The Quality Control Lab Technician is responsible for quality control testing of raw source water, processing water, Reverse Osmosis (RO) water, and Water for Injection (WFI) for drug products to ensure regulatory compliance with the applicable Food and Drug Administration (FDA), State, Local, and quality standards. This position provides quality control support for environmental monitoring (EM), EM testing, site production activities by performing routine and some non-routine testing of raw materials, semi-finished and finished products. This position provides support for product shipping activities by analysis of shipments and assistance to site departments as needed to ensure product quality.

Duties and responsibilities:

Performs microbiological and wet chemistry testing on source water.

Processes and finishes product samples in accordance with Standard Methods and standard operating procedures and policies.

Maintains detailed and accurate documentation of analyses and inspections concerning incoming raw materials, water processing treatment equipment, and production processes.

Collaborates with production and maintenance departments on various projects as necessary and appropriate.

Assists with cleaning and sanitation (Clean-In-Place (CIP)) duties for the water processing equipment as necessary and appropriate.

Manages multiple tasks and priorities while maintaining detailed and accurate records, quality and safety standards.

Understands and uses processing and batching computer controls to effectively changeover duties related to analytical support and production lines as needed.

Assists the sterile manufacturing team with sterile component preparations and batch record preparations.

Assists the sterile manufacturing team in sterile drug product bulk compounding, fill line preparations, line clearances, change part dis-assembling, assembling, visual inspection, labeling, packaging and cGMP document and data verifications.

Performs other duties as assigned.

### *3. Рекомендации по подготовке ролевой игры.*

Ролевые игры – это разновидность игрового обучения, заключающаяся в воспроизведении действий и отношений других людей в рамках ситуации, приближенной к реальной. Ролевая игра по теме 2.3. «Химический элемент (на выбор обучающегося)» проводится в форме научно-практической конференции.

Результативность ролевой игры во многом зависит от особенностей ее организации, проведения, а также тщательности самостоятельной подготовки обучающегося.

Самостоятельная подготовка обучающихся к игре включает составление доклада по выбранному химическому элементу и сопровождение его презентацией.

Компьютерную презентацию, сопровождающую выступление докладчика, удобнее всего подготовить в программе MS PowerPoint. Презентация как тип документа представляет собой последовательность сменяющих друг друга слайдов. Количество слайдов адекватно содержанию и продолжительности выступления (например, для 5-минутного выступления рекомендуется использовать не более 10 слайдов).

На первом слайде обязательно представляется тема выступления и сведения об авторах. На следующих слайдах выносится опорный конспект выступления и ключевые слова с тем, чтобы пользоваться ими как планом для выступления.

Примерный план выступления приводится ниже:

1. Discovery (names of scientists, dates, experiments).
2. Position in the Periodic Law (period, series, group, subgroup, symbol, name, ordinal number, atomic weight, electron formula).
3. Occurrence in nature (free or combined state, abundance (distribution), deposits).
4. Physical properties (odour, olour, taste, b. p., m. p, state of aggregation, other properties).
5. Chemical properties (chemical activity, main reactions, main compounds, other properties).
6. Preparation (main methods).

7. Application (in industry, in engineering, in agriculture, in medicine and pharmacy, in everyday life).
8. Importance (for national economy, for a man).

**Текстовые материалы к учебной конференции по теме 2.3. «Химический элемент (на выбор обучающегося)»:**

## Iron

Iron is the second most abundant metal in nature after aluminium. But native iron is extremely rare. Probably, the first iron used by our forefathers was of a meteoritic origin.

Iron oxidizes readily in the presence of water and air and is found mainly in the form of oxides. Oxidation of iron is responsible for the fact that extant articles made of iron in antiquity are extremely rare. Man discovered iron about five thousand years ago. At first iron was very expensive and was valued much higher than gold; very often iron jewellery was set in gold.

Peoples of all continents became aware of gold, silver, and copper approximately at the same time; but in the case of iron the situation is different. Thus, in Egypt and Mesopotamia the process of extracting iron from ores was discovered two thousand years B.C.; in Trans-Caucasus, Asia Minor, and ancient Greece at the end of the second millenium; in India in the middle of the second millenium; and in China much later, only in the middle of the first millenium B.C. In the countries of the New World[4] Iron Age began only with the arrival of Europeans, i.e. in the second millenium A.D.; some African tribes began to use iron skipping the Bronze Age period in development. This is due to the difference in natural conditions. In countries where natural resources of copper and tin were small, a demand arose for replacing these metals. America had one of the largest deposits of native copper and, therefore, it was not necessary to search for new metals. Gradually, production of iron grew and iron began to pass from the category of precious metals into that of ordinary ones. By the beginning of the Christian era iron was already widely used.

Among all metals and alloys known by that time, iron was the hardest one. Therefore, as soon as iron grew relatively cheap, various tools and weapons were manufactured from it. At the beginning of the first millenium A.D. production of iron in Europe and Asia had made considerable progress; particularly great successes in smelting and processing iron had been achieved by Indian metallurgists. It is interesting to have a look at the development of iron production methods. At first man used only meteoritic iron, which was very rare and therefore expensive. Then people learnt how to produce iron by intensively heating its ores with coal on windy sites. Iron thus obtained was spongy, of low grade, and with large inclusions of slag. An important step in iron production was made with the invention of a furnace open at the top and lined with a refractory material inside. Excavations of ancient towns in Syria indicate that iron of a rather good quality was produced in this way. Later, people noted that cast iron, which had been considered to be a waste product, could be transformed into iron, the process requiring much less coal and yielding high-quality iron.

By the end of the 15th century first smelting furnaces appeared producing exclusively cast iron. Iron and steel smelting processes were rapidly improving. In 1855 there appeared the converter process of steel making which is still used. The Martin process developed in 1865 yields steel almost free of slags.

A chemical symbol Fe originates from the Latin *ferrum*, which means ―iron.

## Sodium and Potassium

Man had known sodium and potassium compounds for a very long time. Carbonates of these metals were used in Egypt for laundry. Common salt, one of the most widespread sodium compounds, was used in foods from time immemorial; in some countries it was very expensive and sometimes wars were waged for the right to possess salt mines. Sodium carbonate was usually obtained from salt lakes whereas potassium carbonate by leaching plant ash; for this reason the former was named mineral alkali and the latter vegetable alkali. The word ―alkali‖ was introduced by Geber, a medieval alchemist, although he made no distinction between the two carbonates. The differences in their nature were first mentioned in 1683. The Dutch scientist I. Bon noted that when soda and potash were used in the similar process, the shapes of the precipitated crystals were different depending on the initial product.

In 1702 G. Stahl noted the difference in crystals of some sodium and potassium compounds. This was an important step in distinguishing between soda and potash. In 1736 the French chemist A. Monsean proved that soda was always present in common salt, Glauber's salt, and in borax. Since an acidic constituent of soda was known, the nature of the basic constituent was of great interest. According to Monsean, soda formed Glauber's salt with sulphuric acid, cubic saltpeter (sodium nitrate) with nitric acid, and a variety of sea salt with hydrochloric acid: isn't this reason enough to deduce that soda is the basis of sea salt?

Although chemists had suspected for a long time that alkali earths were oxides of metals, the nature of soda and potash had not been studied up to the early 19th century. Even Lavoisier had no definite idea on this subject. He did not know what the basic constituents of soda and potash were and assumed that nitrogen could be a constituent. This confusion seems to stem from the similarity between the properties of sodium, potassium, and ammonium salts.

Credit for determining these constituents belongs to H. Davy. At first he was dogged by failures: he could not separate metals from soda and potash with the aid of a galvanic battery. However, soon the scientist understood his error – he used saturated aqueous solutions but the presence of water hinders decomposition. In October, 1807, Davy decided to melt anhydrous potash, and as soon as he started electrolysis of the alkali hydroxide melt, small balls resembling mercury with bright metallic lustre appeared on the negative electrode immersed into the melt. Some of the balls burnt up immediately with an explosion forming bright flame while the others did not burn, but just dimmed and became covered with a white film. Davy concluded that numerous experiments had shown that the balls were the substance which he had been looking for and this substance was highly inflammable potassium hydroxide.

Davy studied this metal thoroughly and found that when it reacted with water the resulting flame was due to burning of the hydrogen liberated from water. Having studied the metal obtained from potassium hydroxide, H. Davy began to search for sodium hydroxide using the same method and he succeeded in separating another alkali metal. The scientist noted that for its preparation a much more powerful battery was required than in the experiments with potash. Nevertheless, the properties of both metals turned out to be similar. For a short time the scientist carefully studied the properties of potassium and sodium. Some chemists doubted the elemental nature of sodium and potassium believing that they were compounds of alkalis with hydrogen. However, Gay Lussac and Thenard proved convincingly[7]that Davy had, indeed, obtained simple substances.

## Resembling Barium

When the Curies and G. Bemont analysed pitchblende[1] they noticed a higher radioactivity of one more fraction apart from the bismuth fraction. After they had succeeded in extracting polonium they started to analyse the second fraction thinking that they could find yet another unknown radioactive element. The new element was named radium from the Latin *radius* meaning ray. The birthday of radium was December 26, 1898 when the members of the Paris Academy of Sciences heard a report entitled ―On a new highly radioactive substance contained in pitchblende‖. The authors reported that they had managed to extract from the uranium ore tailings a substance containing a new element whose properties are very similar to those of barium. The amount of radium contained in barium chloride proved to be sufficient for recording its spectrum. This was done by the well-known French spectral analyst E. Demarcay who found a new line in the spectrum of the extracted substance. Thus, two methods – radiometry and spectroscopy – almost simultaneously substantiated the existence of a new radioactive element.

The position of radium among the natural radioactive elements (of course, excluding thorium and uranium) almost immediately proved to be the most favourable one owing to many reasons. The half-life of radium was soon found to be fairly long, namely, 1600 years. The content of radium in the uranium ores was much higher than that of polonium (4300 times higher); this contributed to natural accumulation of radium. Furthermore, the intensity of alpha radiation of radium was sufficiently high to allow an easy monitoring of its behaviour in various chemical procedures. Finally, a distinguishing feature of radium was that it evolved a radioactive gas. Radium was a convenient subject for studies owing to a favourable combination of its properties and therefore it became the first radioactive element (again, with the exception of uranium and thorium) to find its permanent place in the periodic system without long delay. Firstly, chemical and spectral studies of radium demonstrated that in all respects it belongs to the subgroup of alkaline earth metals; secondly, its relative atomic mass could be determined accurately enough. To do this sufficient amounts of a radium preparation had to be obtained. The Curies worked ceaselessly for 45 months in their ill-equipped laboratory processing uranium ore tailings from Bohemian mines. They performed fractional crystallization about 10000 times and finally obtained a priceless prize - 0.1g of radium chloride. The history of science knows no more noble example of enthusiastic work. This amount was sufficient for measurements and on March 28, 1902, Marie Curie reported that the relative atomic mass of radium was 225.9 (which does not differ much from the current figure of 226.02). This value just suited the suggested position of radium in the periodic system.

The discovery of radium was the best substantiated one among the many alleged discoveries of radioactive elements, which soon followed. Every year more new discoveries were reported. Radium was also the first radioactive element obtained in the metallic form.

Marie Curie and her collaborator A. Debierne electrolyzed a solution containing 0.106 g of radium chloride. Metallic radium deposited on the mercury cathode forming amalgam. The amalgam was put into an iron vessel and heated under a hydrogen flow to remove mercury. Then grains of silvery whitish metal glistened at the bottom of the vessel.

The discovery of radium was one of the major triumphs of science. The studies of radium contributed to fundamental changes in our knowledge of the properties and structure of matter and gave rise to the concept of atomic energy. Finally, radium was also the first radioactive element to be practically used (for instance, in medicine).

## Radium

At the end of the 19th century uranium compounds were investigated and were found to emit penetrating rays. These rays were discovered to affect a protected photographic plate in much the same manner as X - rays. Besides, these rays were observed to cause the air through which they pass to become a conductor of electricity. The rays from uranium compounds were found to differ from X- rays, however, in that they were not produced by any artificial means. Instead, they appeared to be emitted by certain materials quite spontaneously. The production of these rays, therefore, proved to be a perfectly natural process. Further work showed that a uranium mineral called pitchblende was much more strongly radioactive than could be accounted for by its content of uranium alone. Pitchblende was therefore suspected of containing some undiscovered element of greater radioactive power than uranium itself.

The research of the unknown element was undertaken by a Polish woman, living in France, Mary Curie, who together with her husband, Pierre Curie, discovered the element she was searching for. The element was given the name radium and was stated by M. Curie to resemble barium in being precipitable as an insoluble sulphate. The atomic weight of the radium was found by M. Curie by the analysis of radium chloride to be approximately 225, and later she obtained the more accurate value, 226.2, by the analysis of a relatively large quantity (0.1 gr.) of pure radium bromide.

Radium is interesting particularly because it emits rays which are similar to those first discovered in the case of uranium. This property has been named radiactivity and the substances that emit penetrating radiations are said to be radioactive. The rays emitted possess energy as shown by their ability to affect the photographic plate, to cause zinc sulphide to emit light, and to render air a conductor of electricity. In addition, the emission of rays may be shown to be attended by a liberation of heat; one gram of radium has been estimated to evolve as much as 133 calories of heat per hour. The evolution of heat does not depend on whether the radium is present as a chloride, a bromide, or in metallic form. This seems evidence that the emission of heat is a property of the radium atom. Thus, radium atom may be seen to be a source of energy that is released, in part, during the radioactive disintegration.

## Silicon (1)

Silicon is the second most abundant element on Earth after oxygen. Although it constitutes 28 per cent of the earth's crust, its abundance did not make for its early discovery. The reason for this lies in the difficulty of reducing silicon from its oxide.

Generally speaking, there is every ground to classify silicon as an element of antiquity. Its compounds were known and used from time immemorial (suffice it to mention silicon tools of primitive man). We classified carbon as an element of antiquity since it was known in a free state from very remote times. However, that carbon is a chemical element became clear only two hundred years ago. Glass, in the long run, is also a silicon material. However, the date of silicon discovery is the date of its preparation in a free state since such is the established practice in the history of science.

At the turn of the 18th century many scientists believed that silica, or silica earth, contained an unknown chemical element and tried to isolate it in a free state. H. Davy attempted to decompose silica with an electric current – the method by which a number of alkali metals had already been prepared – but without success. The scientist's attempt to prepare free silicon by passing metallic potassium vapour over red-hot silicon oxide also failed. In 1811 L. J. Gay Lussac and L. Thenard applied themselves to the problem. They observed a vigorous reaction between silicon tetra-fluoride and metallic potassium; a reddish brown compound was formed in the reaction. The scientists could not reveal the nature of the product; most likely, it was contaminated amorphous silicon.

At last, in 1823, J. Berzelius had a stroke of good luck. The Swedish chemist heated a ground mixture of silicon oxide, iron, and charcoal to a high temperature and obtained an alloy of silicon and iron (ferrosilicium), the composition of which he was able to prove. To separate free silicon, J. Berzelius

repeated L. Thenard and L.J. Gay Lussac's experiments and also obtained a brown mass. Under the action of water, hydrogen was liberated and free amorphous silicon was formed as a dark brown insoluble powder which contained potassium silicofluoride as an impurity. Berzelius removed the impurity by washing the precipitate for a very long time.

Another method proposed by J. Berzelius – calcination of potassium fluorosilicate with an excess of potassium – proved to be more successful and straightforward. The sintered mass was decomposed with water and, as a result, pure amorphous silicon was obtained. J. Berzelius showed that upon calcination silicon was transformed into silica; this makes Berzelius the discoverer of silicon. Crystalline silicon was obtained in 1854 by A. Saint Claire Deville during separation of metallic aluminium. The Latin name ―silicium‖ originates from *silex* meaniing ―a hard stone‖.

### Silicon (2)

Silicon does not occur free in nature. Compounds of silicon make up about 27.6 per cent of the matter in the crust of the earth, and the element ranks next after oxygen in abundance.

It follows carbon in Column IVB of the Periodic Table and its chemistry like that of carbon is complex. Silicon plays an important part in the inorganic world. The importance of carbon in organic chemistry results from its possessing the ability to form carbon-carbon bonds, which permits complex molecules, with the most varied properties to exist. The importance of silicon in inorganic world results from a different property of the element. Silicon molecules exist in chains and more complex structure, in which the silicon atoms are characterized by being connected by oxygen atoms.

The important compounds of silicon and carbon are not at all similar. These differences are due to the silicon atom having a much larger radius than the carbon atom. The attraction of the nucleus for electrons is less in the silicon atom than in the carbon atom.

Although the compounds of silicon have been used for many centuries the element was not prepared until after the beginning of the 19th century. Many methods are now in use for preparing silicon. One of them is to heat silicon dioxide with magnesium:

$SiO_2 + 2Mg = Si + 2MgO$

One way of preparing silicon industrially is by reducing the dioxide ($SiO_2$) with carbon in an electric furnace. Some difficulty is encountered in preventing silicon and carbon from reacting to form a carbide, but a product containing up to 98 per cent of silicon is made by this reaction.

Silicon resembles carbon in having crystalline as well as amorphous form. The latter is a brown powder that really consists of very small crystals. Crystalline silicon has a structure resembling that of diamond. They are alike in being very hard. Crystalline silicon is hard enough to scratch glass. Crystalline silicon is less active in chemical reactions than amorphous form.

Besides being employed in the steel industry free silicon has few uses. But the compounds of silicon have a wide application.

## *4. Рекомендации по выполнению тестовых заданий*

Тестовые задания предусматривают закрепление теоретических знаний, полученных студентом во время занятий по данной дисциплине. Их назначение – углубить, систематизировать и проверить знания студентов по отдельным темам, а также языковые и речевые навыки и умения.

Перед выполнением тестовых заданий необходимо повторить разделы учебного материала, рекомендованные преподавателем. При подготовке следует также обращаться к грамматическим пособиям и собственным конспектам обучающегося.

В тестах предусмотрены задания различных типов: закрытые тесты, в которых нужно выбрать один верный вариант ответа из представленных; задания на сопоставление; открытые тесты, где предстоит самостоятельно заполнить пропуски или ответить на поставленный вопрос.

*Пример задания закрытого типа по теме 4.2 «Лаборант по контролю качества: перспективы профессии»*:

Chemists _____ (make) experiments with different substances.

a) is made **b) are made**

c) were made d) have made

*Пример задания открытого типа по теме 4.2 «Лаборант по контролю качества: перспективы профессии»*:

What types of glassware can be found in the chemical laboratory?

Ответ: glassware for general use, glassware for special use, glassware for measuring.

## *5. Рекомендации по выполнению контрольной работы*

Цель контрольной работы – углубить, систематизировать и проверить знания студентов по отдельным темам, а также языковые и речевые навыки и умения.

После обсуждения грамматического и нового лексического материала на практических занятиях обучающиеся выполняют задания самостоятельно, тем самым закрепляя изученный материал. Студенту следует тщательно готовиться к выполнению контрольной работы. Положительный результат будет получен, если он систематически посещает занятия по дисциплине, активно участвует в работе на них, самостоятельно работает по программе курса.

Задания контрольной работы сгруппированы по темам:

1. Академия: прошлое и настоящее.
2. Кислород. Водород.
3. Химическая лаборатория: оборудование.

## *6. Рекомендации по переводу литературы*

При переводе литературы рекомендуется следующая последовательность работы над текстом:

1. Прочитать весь текст (фрагмент) и постараться уяснить его общее содержание.

2. Каждое сложное предложение разбить на отдельные предложения: сложноподчиненные – на главное и придаточное, а сложносочиненные – на простые.

3. При анализе сложных по своей структуре предложений, в которых не сразу можно определить составляющие их элементы, рекомендуется, прежде всего, найти сказуемое главного и придаточных предложений.

4. В каждом предложении определить группу сказуемого (по личной форме глагола), затем найти группу подлежащего и группу дополнения.

5. Перевод предложения начинать с группы подлежащего, затем переводить группу сказуемого, дополнения и обстоятельства.

6. Найти незнакомые слова в общем и/или специализированном словаре, уяснив предварительно, какой частью речи они являются в данном предложении. При этом не брать первое значение слова, а внимательно изучить все значения, представленные в словарной статье, и выбрать наиболее подходящее по содержанию переводимого текста. Выписать незнакомые слова в терминологический словарь, указать перевод на русский язык.

### Тексты для перевода по теме 2.3 «Химический элемент (на выбор обучающегося)»

### Named after the Moon

Selenium is still another element that chemists had met long before its discovery, but failed to identify owing to its having been masked[1] by the presence of other similar elements. Thus, selenium remained undiscovered, ―hiding‖ behind sulphur and tellurium. Only in 1817 did it surrender to the Swedish chemists – the famous J. Berzelius and his assistant G. Gahn. Inspecting a sulphuric acid factory in Gripsholm on September 23, they found a small amount of a precipitate, partially red and partially light brown, in sulphuric acid. On heating in the flame of a blowpipe[2], the precipitate emitted a weak smell of radish[3] and transformed into a regulus[4] with a leaden lustre. In Klaproth's opinion the smell of radish pointed to the presence of tellurium. Similar smell was noticed in the Falun[5] mine where pyrite required for the acid production was extracted. Curiosity and hope to find this rare metal in the brown precipitate forced Berzelius to investigate it. However, he did not discover tellurium. Then he collected the deposits formed after several months of sulphur combustion for sulphuric acid production in the Falun factory and obtained a large amount of precipitate. Thoroughly analysing the precipitate, Berzelius came to the conclusion that it contained an unknown metal whose properties were similar to those of tellurium. By analogy, the new metal was named "selenium" from the Greek selenus for the Moon (as tellurium is named after our planet). Berzelius studied many properties of selenium and described them in an article "The Study of a New Mineral Body Found in Sulphur Extracted in Falun" published in 1818 in the journal *Annales de chimie et de physique.*

***Notes:***

1. owing to its having been masked – из-за того, что он был скрыт
2. blowpipe – паяльная трубка
3. radish – редис
4. regulus – королѐк металла (*фракция металлических включений, содержащая драгоценные металлы*)
5. Falun – город в Швеции

## Named after the Earth

In the second half of the 18th century a strange bluish-white ore was discovered in Austria or, to be more exact[1], in the part of it that was called Siebengebirge (Seven Mountains). It was strange because there was no common opinion about its composition. The debates mainly revolved around the question whether it contained gold or not. Its names were also unusual: paradoxical gold, white gold, and, finally, problematic gold. Some scientists believed that there was no problem at all, and the ore, most likely, contained antimony[2] or bismuth, or both. In 1782 the mining engineer I. Muller (later Baron von Reichenstein) subjected the ore to a thorough chemical analysis and extracted metal reguluses from it which, as it seemed to him, closely resembled antimony. But in the following year he decided that in spite of[3] the resemblance, he was dealing with[4] a new, previously unknown metal. Not relying upon his own opinion, the scientist consulted T. Bergman. But the sample of the ore sent to Bergman was too small to come to a definite conclusion. It was only possible to establish that Muller's metal was not antimony, and that was the end of the matter. During the next fifteen years nobody recalled the discovery of the Austrian mining engineer. Tellurium's real birth was still ahead.

Its second birth was promoted by the German chemist M. Klaproth. At the Berlin Academy of Sciences session on January 25, 1798, he reported about the gold-bearing ore from "Seven Mountains". Klaproth repeated what Muller had done in his time. But if the latter was in doubt there was no doubt for

M. Klaproth. He named the new element "tellurium" (from the Latin *tellas* for "Earth"). Although Klaproth had received the reo sample from Muller, he did not want to share the glory of the discoverer of tellurium with him. We, for our part[5], think that the role of the German chemist was no less important. At any rate he revived the forgotten element.

There is reason to believe that the third person was also involved in the discovery of tellurium. He was P. Kiteibel, a Professor of the Pest[6] University in Hungary, a chemist and botanist. In 1789 he received a mineral which was assumed to be molybdenite containing silver from a colleague. P. Kiteibel extracted a new element from it. Then he established that the same element was present in problematic gold. Thus, P. Kiteibel discovered tellurium independently of other scientists. It is a pity[7] that he did not publish at once[8] his findings but instead sent a description of his investigation to some of his colleagues and, in particular, to the Viennese[9] mineralogist F. Estner. M. Klaproth learned about Kiteibel's results through F. Estner and spoke favourably of them without actually corroborating them. I. Muller wrote to M. Klaproth several years later and the latter found time to reproduce the results of his correspondent. After that Klaproth considered him to be the only author of the discovery, and he underlined this in his report.

For a long time tellurium was regarded as metal. In 1832 Berzelius showed its great similarity with selenium and sulphur, and tellurium was once and forever[10] classified as a non-metal.

***Notes:***

1. to be more exact – точнее говоря
2. antimony – сурьма
3. in spite of – несмотря на
4. he was dealing with – он имел дело с
5. for our part – со своей стороны
6. Pest – Пешт (*город в Венгрии*)
7. it is a pity that – жаль, что
8. at once – сразу
9. Viennese – венский
10. once and forever – раз и навсегда

## Beryllium (1)

Academician A.E. Fersman, the outstanding Russian geo-chemist, called beryllium one of the most remarkable elements having tremendous theoretical and practical importance. However, beryllium is not outstanding in any one of its qualities; it has typical properties of metals. What is really remarkable, is the extremely fortunate combination (as if purposely invented by nature) of different properties. Beryllium clearly illustrates how the history of a chemical element is affected by its properties. As regards[1] its chemical behaviour, beryllium has much more in common[2] with aluminium (its diagonally neighbouring element in the periodic table) than with magnesium, its direct analogue in the same group. That is why aluminium was masking the presence of beryllium (as well as of zirconium) in natural minerals for such a long time.

Because of a pronounced amphoteric nature of beryllium, all attempts to obtain beryllium compounds in a sufficiently pure form were unsuccessful for a long time. As a result, many properties of the element and especially its valence and atomic mass were determined incorrectly. Consequently, the place of beryllium in the periodic table was not definitely found for a very long time. Only after it had been firmly established that beryllium is bivalent, that the formula of its oxide is BeO, and atomic mass is 9.01, was it once and for all[3] placed in the upper box of the second group. A great contribution to that was made by the Russian scientist I.V. Avdeev.

The history of beryllium minerals goes far back into the past when such precious stones as beryls and emeralds were already known.

One of the first scientists to begin the study of beryls in 1779 was F. Achard, Professor of Chemistry at the Berlin Academy of Sciences. Before that time he had become famous for developing an industrial method of making sugar from sugar beet. The German chemist performed six analyses. His results recalculated in modern terms show that beryls contain 21.7% silicon oxide, 60.05% aluminium oxide, 5.02% iron oxide, and 8.3% calcium oxide. The total was only 95.07% (five per cent was missing!) but F. Achard had no comment on this.

Similar figures were obtained in 1785 by J. Bindheim: in his case the ―calculations‖ yielded the sum of the components of 101 per cent. So, nothing particular was found about beryls.

In 1797 M. Klaproth, who by that time had already discovered uranium, titanium, and zirconium proving himself an outstanding analyst, received from the Russian diplomat and author D. Golitsyn samples of Peruvian emeralds and analysed them. But M. Klaproth did not wind up with[4] 100 per cent either (66.25% silica, 31.25% alumina, 0.5% iron oxide, total 98%). The scientist did not know where 2 per cent had disappeared and did not try to explain. So he was not fated to add the discovery of the fourth element to his record.

At the same time, in France, another analyst L. Vauquelin, no less skillful than M. Klaproth, was at work. Beginning with 1793 he continued to study beryls and emeralds. But Vauquelin found nothing except ordinary components (silica, alumina, lime, iron oxide). Later Vauquelin recalled how difficult it had been to recognize a new substance when its properties were so similar to those of already known ones, the scientist meant a close similarity between oxides of aluminium and unknown beryllium. Anticipating the events a little, we shall call Vauqelin the real discoverer of beryllium. The logic discovery was not simple and it, undoubtedly, does justice to the scientist. He reasoned in the following way: beryl and emerald are very much alike as regards their composition and the shape of crystals. The crystal shape is absolutely the same but what about composition? Vauquelin's predecessors found the same components (alumina, silica, lime) in both minerals but their content varied.

After the first unsuccessful experiments L. Vauquelin decided to see why the components content varied so widely. Could it be that[5] the minerals contained ―something‖ else which was either lost in the course of the reaction or, figuratively speaking[6], was ―hiding behind the backs‖[7] of one of the components (for instance, alumina).

L. Vauquelin had a certain psychological advantage. In 1797 he discovered chromium, which imparts a greenish colour to emerald and is absent in beryl. Hence, the difference between beryl and emerald is an established fact. But not only chromium could be responsible for the difference. February 14, 1798, should be considered as the birthday of beryllium. On that day Vauquelin made a report to the

Paris Academy of Sciences, ―About Aquamarine, or Beryl, and the Discovery of a New Earth in this Mineral‖. He told the audience how he had performed five analyses and how he had become more and more convinced of the existence of the new earth. The first results were as follows:

***Beryl:*** 69 parts of silica, 21 parts of alumina, 8-9 parts of lime, and 1.5 parts of iron oxide. Emerald: 64 parts of silica, 29 parts of alumina, 2 parts of lime, 3-4 parts of chromium oxide, and 1-2 parts of water. Whether it was intuition or something else, but Vauquelin suspected that in both cases alumina contained an impurity. It resembled alumina very much and, therefore, it was rather difficult to detect it. The brilliant intuition of an analyst helped the scientist to discover that the impurity (the new earth), unlike alumina, did not form alum. Later he found other differences. But similarity prevailed over difference enabling beryllium to hide for so long behind aluminium. If beryllium earth is not alumina, L. Vauquelin thought, it is none of the known earths since it differs from them much more than alumina. The scientist proposed to name the new element ―glucinium‖ (symbol Gl) from the Greek *glykys* which means ―sweet‖. The present name ―beryllium‖ was proposed by M. Klaproth who justly noted that some compounds of other elements are also sweet.

As an interesting historical detail we should like to mention that Vauquelin analysed Altaian beryls presented to him by French mineralogist and traveller E. Patren.

The discovery of L. Vauquelin was confirmed by I. Gmelin, the German chemist, a professor of chemistry in Gottingen. He analysed Siberian beryls from Nerchinsk and made the same conclusions as Vauquelin. Metallic beryllium was isolated in 1828 by F. Wohler and E. Bussy who treated beryllium chloride with potassium metal. It was thirty years after the discovery of beryllium.

***Notes:***

1. as regards – что касается
2. has much more in common – имеет гораздо больше общего
3. once and for all – раз и навсегда
4. did not wind up with – не завершил
5. Could it be that – Если бы это могло быть так
6. figuratively speaking – образно говоря
7. was ―hiding behind the backs‖ – «прятался за спиной»

## Beryllium (2)

Beryllium oxide, BeO, is made by heating the hydroxide to 440°C, or better the basic carbonate to 1,100°C. It has a wurtzite (4:1) lattice[1], showing that it is covalent in the solid state; herein[2] it differs from the oxides of the alkaline earths[3] (including magnesium), which all have the ionized sodium chloride (6:1) structure, the differences being due to[4] the smaller size and hence[5] the greater deforming power of the beryllium ion. BeO melts at 2,570°C. It dissolves in acids, but the more slowly the higher it has been heated. It has been shown (from the heat of the solution in hydrofluoric acid) that the energy content of the solid is the greater the lower the temperature of preparation.

This may be due to a more colloidal state of the low temperature specimens[6], with the lattice becoming more complete after exposure to[7] a high temperature; this view is supported[8] by X-ray examination. Beryllium hydroxide, $Be(OH)_2$ is precipitated from the solution of beryllium salts by hydroxyl ion, with the precipitate readily dissolving in the excess of alkali. Other conditions being equal, beryllium hydroxide crystallizes out from the solution slowly only on standing[9].

This implies[10] that there are two forms of hydroxide, one being more soluble and less stable than the other. The conclusion has been confirmed by direct measurement of solubility. The precipitate first formed is gelatinous, this being changed into an unstable crystalline α-form, and that on standing into a stable β-form, which is only about 1/25 as soluble. Contrary to[11] earlier statements, neither the α-form nor the β-form absorbs carbon dioxide. Even the β-form will dissolve in highly concentrated (10N) sodium hydroxide, there being formed the beryllates $NaHB_2O_2$, or $Na_2BeO_2$. Beryllium hydroxide dissolves readily in solutions of beryllium salts. It does not dissolve in solutions of ammonium salts, or of most amines, but it does in a solution of ethelene diamine. Beryllium, unlike all other elements of Group II, will not form peroxide.

***Notes:***

1. wurtyzite lattice – кристаллическая решетка вюрцита
2. herein – в этом
3. alkaline earths – щелочноземельные элементы
4. being due to – обусловлены
5. hence – следовательно, в результате
6. specimens – экземпляры

7. after exposure to – после воздействия
8. is supported by – подтверждается
9. on standing – при отстаивании
10. this implies – это означает
11. contrary to – вопреки

## **“Inflammable Air”**

Hydrogen is one of the most striking elements of the periodic system, its number is one, and it is the lightest of all the existing gases. It is the element whose discovery was indispensable for the solution of many problems of chemical theory. It is an element whose atom, losing its only valence electron, becomes a —bare‖ proton. And, therefore, chemistry of hydrogen is, in a way[1], unique; it is the chemistry of an elementary particle.

Once D.I. Mendeleyev called hydrogen the most typical of typical elements (meaning the elements of the short periods in the System), because it begins the natural series of chemical elements.

And such a fascinating element is readily available: it can be obtained without difficulty in any school laboratory, for instance, by pouring hydrochloric acid on zinc shavings.

Even in those bygone times[2], when chemistry was not a science yet and when alchemists were still searching for the —philosophers‘ stone‖, hydrochloric, sulphuric, and nitric acids as well as iron and zinc were already known. In other words, man had in his possession[3] all components whose reaction could give rise[4] to hydrogen. Only a chance was needed and chemical literature of the 16-18th centuries reported that many times chemists observed how the pouring of, for instance, sulphuric acid on iron shavings produced bubbles of a gas which they believed to be an inflammable variety of air. One of those who observed this mysterious variety of air was the famous Russian scientist M. V. Lomonosov. In 1745 he wrote a thesis, *On Metallic Lustre*, which said, among other things: —On dissolution of some base metal, especially iron, in acidic alcohols, inflammable vapour shots out from the opening of the flask.

« (According to the terminology of those times, acidic alcohols meant acids). Thus, M.V. Lomonosov observed none other than hydrogen. But the sentence went on to read: —… which is phlogiston[5].‖ Since metal dissolved in the acid liberating *materia ignea* or —inflammable vapour‖, it was very convenient to assume that dissolving metal releases phlogiston: everything fits nicely into the theory of phlogiston.

And now is the time to meet the outstanding English scientist H. Cavendish, a man fanatically devoted to science and an excellent experimenter. He never hurried with making public his experimental results and sometimes several years had to pass before his articles appeared. Therefore, it is difficult to pinpoint[6] the date when the scientist observed and described the liberation of "inflammable air". What is known is that this work published in 1766 and entitled *"Experiments with Artificial Air"* was done as a part of pneumatic chemistry research. It is also likely that the work was performed under the influence of J. Black. H. Cavendish had become interested in fixed air and decided to see whether there existed other types of artificial air. In this manner[7] the scientist referred to the variety of air which is contained in compounds in a bound state and which can be separated from them artificially. H. Cavendish knew that inflammable air had been observed many times. He himself obtained it by the same technique: the action of sulphuric and hydrochloric acids on iron, zinc, and tin, but he was the first to obtain definite proof that the same type of air was formed in all cases - inflammable air. And he was the first to notice the unusual properties of inflammable air. As a follower of the phlogistic theory, H. Cavendish could give only one interpretation of the substance's nature. Like M.V. Lomonosov, he identified it as phlogiston. Studying the properties of inflammable air, he was sure that he was studying the properties of phlogiston. H.

Cavendish believed that different metals contain different proportions of inflammable air. Thus, to the fixed air of J. Black, the inflammable air of H. Cavendish was added. Strictly speaking, the two scientists discovered nothing new: each of them only summarized the data of previous observations. But this summing up represented considerable progress in the history of human knowledge.

Fixed air and inflammable air differed both from ordinary air and from each other. Inflammable air was surprisingly light. H. Cavendish found that phlogiston, which he had separated, had a mass. He was the first to introduce a quantity to characterize gases, that of density. Having assumed the density of air to be unity, Cavendish obtained the density of 0.09 for inflammable air and 1.57 for fixed air. But here a contradiction arose between Cavendish the experimenter and Cavendish the adherent of the phlogistic theory. Since inflammable air had a positive mass, it could by no means[8] be considered to be pure phlogiston. Otherwise, metals losing inflammable air would have to lose mass as well. To avoid the contradiction, Cavendish proposed an original hypothesis: inflammable air is a combination of phlogiston and water. The essence of the hypothesis was that at last hydrogen appeared in the composition of inflammable air.

The evident conclusion is that Cavendish, like his predecessors, did not understand the nature of inflammable air, although he had weighed it, described its properties, and considered it to be independent kind of artificial air. In a word[9], Cavendish, unaware of the fact, studied ―phlogiston‖ obtained by him as he would have studied a new chemical element. But Cavendish could not perceive that inflammable air was a gaseous chemical element – so strong were the chains of the phlogistic theory. And having found that the real properties of inflammable air contradicted this theory, he came up with a new hypothesis, as erroneous as the theory itself.

Therefore, strictly speaking, the phrase ―hydrogen was discovered in 1766 by the English scientist H. Cavendish‖ is meaningless. Cavendish described the processes of preparation and the properties of inflammable air in greater detail than his predecessors. However, he ―knew nor what he was doing‖. The elementary nature of inflammable air remained beyond his grasp[10]. It was not scientist‘s fault, however, chemistry had not yet matured enough for such an insight. Many years have passed before hydrogen became, at last, hydrogen and occupied its proper place in chemistry.

Its Latin name *hydrogenium* stems from the Greek words *hydr* and *gennao* which mean ―producing water‖. The name was proposed in 1779 by A. Lavoisier after the composition of water had been established. The symbol *H* was proposed by J. Berzelius.

Hydrogen is a unique element in the sense[11] that its isotopes differ in their physical and chemical properties. At one time[12] this difference prompted some scientists to consider hydrogen isotopes as independent elements and to find for them special boxes in the periodic table. Therefore, the history of the discovery of hydrogen isotopes is of special interest, as a continuation of the history of hydrogen itself. The search for hydrogen isotopes began in the twenties of the 20th century but all attempts were unsuccessful, resulting in the belief[13] that hydrogen had no isotopes. In 1931 it was suggested that hydrogen, nevertheless, contains a heavy isotope with a mass number of 2. Since this isotope had to be twice as heavy as hydrogen, the scientists tried to isolate heavy hydrogen by physical methods. In 1932 the American scientists Urey, Brickwedde, and Murphy evaporated liquid hydrogen and, studying the residue by spectroscopy, found a heavy isotope in it. In the atmosphere it was discovered only in 1941. The name "deuterium" originates from the Greek word *deateros* which means "second, another one". The next isotope with a mass number of 3, tritium (from the Greek *tritos*—the third), is radioactive and was discovered in 1934 by English scientists M. Oliphant, P. Hartec, and E. Rutherford. The name "protium" was assigned to the main hydrogen isotope. This is the only case when isotopes of the same element have different names and symbols (H, $D_t$ and T). 99.99 per cent of all hydrogen is protium; the rest is deuterium with only traces of tritium.

***Notes:***

1. in a way – в некотором смысле; можно сказать; отчасти
2. Even in those bygone times ... – Даже в далеком прошлом ...
3. in his possession – в своем распоряжении
4. give rise – быть источником; дать начало
5. phylogiston – флогистон (от греч. *phlogistos* – воспламеняемый, горючий)
6. to pinpoint – точно определить; указать
7. in this manner – таким образом
8. by no means – никоим образом
9. in a word – одним словом; короче говоря
10. beyond his grasp – выше его понимания
11. in the since – в том смысле
12. at one time – одно время (разом, сразу, одновременно)
13. resulting in the belief – что привело к убеждению (мнению)

## Yellow – Green Halogen

In ancient times man knew of such chlorine-containing compounds as sodium chloride NaCl and ammonium chloride $NH_4Cl$. Later hydrochloric acid (HCl) became known and widely used. Numerous chlorine compounds were subjected to the scrutiny[1] of researchers and there is no doubt that during manipulations with them free chlorine was repeatedly obtained. Among those who obseryed free chlorine were such outstanding scientists as J. Glauber (of the Glauber's salt fame), J. Van Helmont, and R. Boyle. But even if this strange yellow-green gas had caught their attention, they would have hardly understood its nature.

The Swedish chemist C. Scheele was also mistaken. He prepared chlorine by the same method that is described in modern school textbook: by the reaction of hydrochloric acid with manganese oxide (Scheele made use of ground pyrolusite, that is natural $MnO_2$). It would be wrong to say that the scientist

chose this method by chance[2]. Scheele knew that the reaction of HC1 with pyrolusite had to give rise [3] as usual to inflammable air (known subsequently as hydrogen). Some gas was, indeed, liberated but it did not bore even remote likeness to inflammable air. It had a very unpleasant smell and an unpleasant yellow-green colour. The gas corroded corks and bleached flowers and plant leaves. The new gas proved to be a highly active chemical reagent. It reacted with many metals and, when with ammonia, formed a dense smoke (ammonium chloride $NH_4Cl$). Its solubility in water was poor. Scheele did not utter the words "a new chemical element", although he had the discovery within his grasp[4] and could follow the logical chain of arguments about its elementary nature. A zealous follower of the phlogistic theory, the Swedish chemist identified the gas discovered by him with hydrochloric acid that had lost phlogiston[5]. He named it ―dephlogisticated hydrochloric acid or dephlogisticated muric acid‖ (HC1 was named muric acid after the Latin *muria*, ―brine, salt water‖). At that time Scheele shared the opinion of H. Cavendish and other scientists that inflammable air (hydrogen) was actually phlogiston. It followed that the new gas had to be a simple substance (hydrochloric acid minus phlogiston) but Scheele did not make such seemingly obvious conclusion. Although 1774 is considered to be the new gas's date of discovery, much time was to pass before its nature was properly understood.

A. Lavoisier overturned the phlogistic theory. Even the name "dephlogisticated muric acid" evoked a strong protest in him. In his opinion, the acid obtained by Scheele was a compound of muric (hydrochloric) acid and oxygen. Oxidized muric acid—that is how Lavoisier named what we know as elemental chlorine now. The French chemist believed that all acids must contain oxygen combined with some element. Lavoisier called this element ―murium‖ in the case of muric acid and included it into his ―Table of Simple Bodies‖.

The result was paradoxical; trying to elucidate the nature of the gas discovered by Scheele, Lavoisier only complicated the issue. Probably, this development in the history of chlorine was simply inevitable in the light of new theoretical conceptions. Some chemists attempted to prepare free murium but the attempts were fruitless and the nature of the new gas did not become clearer.

In 1807 H. Davy tried to solve the problem, subjecting the notorious muric acid to various manipulations. He attempted to decompose it electrolytically, but no decomposition was observed. No matter**[6]** how ingeniously he treated oxymuric acid, he could not succeed in preparing water or liberating oxygen. In a word**[7]**, the acid behaved as if it were**[8]** a simple substance. Moreover, its action on metals or their oxides yielded typical salts. Nothing else was left to Davy but to recognize that oxymuric acid consisted of only one simple substance, i.e. to recognize the elemental nature of the gas discovered more than 30 years earlier by Scheele. He reported on this to the Royal Society on November 19, 1810. Davy proposed to name the element ―chlorine‖ from the Greek *chloros* meaning ―yellow-green‖. Two years later, in 1812, the French chemist Gay Lussac proposed to change the name for "chlor" (which became generally accepted except in English-speaking countries).

Gay Lussac in cooperation with Thenard began to study oxymuric acid almost simultaneously with Davy; at first, they wanted to prove that it was oxygen-free. The two scientists passed the acid through a red-hot porcelain tube over charcoal. If there had been oxygen in the gas discovered by Scheele, it would have been absorbed by the charcoal. Although the composition of the gas at the inlet and outlet of the tube remained unchanged, this experiment did not shake the belief of the firm followers of A. Lavoisier about the composition of oxymuric acid.

Nevertheless, Davy's experiments strongly impressed the contemporary scientific community which gradually came to the conclusion that murium was in fact chlorine. In 1813 Gay Lussac and Thenard agreed with Davy. Only Berzelius for a long time continued to doubt the elemental nature of chlorine but in the end he also had to accept the truth. The elemental nature of chlorine became an irrefutable fact only after the discovery and study of iodine and bromine.

In 1811 the German chemist I. Schweiger proposed to name chlorine a ―halogen‖ (from the Greek for ―salt‖ and ―produce‖, i.e. ―salt-producing‖) because of its ability to combine readily with alkaline metals. At that time the name was not accepted but later it became common for the group of similar elements: fluorine, chlorine, bromine, and iodine. Chlorine was obtained for the first time in a liquid form in 1823 by M. Faraday.

***Notes:***

1. scrutiny – внимательное изучение
2. by chance – случайно
3. to give rise to – вызывать, давать в результате
4. within his grasp – так близко, что можно рукой достать; в пределах его возможностей
5. phlogiston – от греч. ―phlogistos‖ воспламеняемый, горючий
6. no matter – не имеет значения
7. in a word – одним словом
8. as if it were – как если бы это было

## “Violet Colour”

Iodine was the second halogen to be obtained in a free state. Both the appearance and chemical properties of iodine are rather peculiar. Were it the only halogen in existence**[1]**, chemists would have to think hard about its nature, but the elemental chlorine had already been known and this fact helped to understand the nature of iodine.

B. Courtois, an entrepreneur from the French town of Dijon[2], was engaged, among other things, in the production of potash and saltpeter. He used ash of sea algae as the initial raw material. A mother solution of sea algae was formed under the action of water on the ash. Today we know that the ash contains chlorides, bromides, iodides, carbonates, and sulphates of some alkali and alkaline-earth metals. However, when Courtois performed his experiments it was only known that the ash contained potassium and sodium compounds (chlorides, carbonates, and sulphates). Upon evaporation, first, sodium chloride precipitated and then potassium chloride and sulphate. The residual mother solution contained a complex mixture of various salts, including sulphur-containing ones.

To decompose these sulphur compounds, Courtois added sulphuric acid to the solution. One day it so happened that he added a greater amount of acid than was necessary. Suddenly something unexpected happened: amazingly beautiful clouds of violet vapour appeared whose magnificence was marred[3] only by their unpleasant, even lachrymose smell[4]. Then followed something even more surprising: on the surface of cold objects the vapour did not condense forming heavy drops of a violet liquid but precipitated at once as dark crystals with metallic lustre. Courtois discovered many other interesting and unusual properties of the new substance. He had every reason to announce the discovery of a new chemical element but, evidently, the researcher was not confident enough and his laboratory was too poorly equipped to perform further investigations. He, therefore, turned for help to his friends, Ch. Desormes and N. Clement, asking them for a permission to continue his experiments in their laboratory. He also asked them to report his discovery in a scientific journal.

Consequently, the report about ―The Discovery of a New Substance Obtained from an Alkali Salt by Mr. Courtois‖ signed by N. Clement and Ch. Desormes appeared only in 1813 in the ―Annales de chimie et de physique‖[5], i.e. two years after the discovery of the element. To enable other chemists to investigate the substance, B. Courtois gave a very small amount of it to a pharmaceutical firm in Dijon. Clement himself prepared a certain amount of iodine, studied its properties and was, probably, the first to advance an opinion that iodine resembled chlorine. In 1813 J. Gay Lussac and H. Davy independently of each other proved the elemental nature of iodine. The French chemist suggested the name ―iode‖ for the new element (from the Greek *iodes* meaning ―violet colour‖) and the English scientist suggested the name ―iodine‖. The first name found acceptance in the Russian language.

Iodine is a rare example of a chemical element whose properties were studied thoroughly during a short period of time after its discovery. Here a great contribution was made by Gay Lussac who even wrote a book on iodine which was in effect the first monograph in the history of science completely devoted to one element.

But the subsequent generations did not forget B. Courtois's contribution. A street in Dijon is named after him; this honour was bestowed on[6] very few discoverers of chemical elements.

***Notes:***

1. Were it the only halogen in existence – Даже если бы существовал (был) один единственный галоген
2. Dijon – Дижон (.город во Франции)
3. was marred – был испорчен
4. lachrymose smell – запах, вызывающий слезоточение
5. Annales de chimie et de physique‖ – «Основы химии и физики»
6. was bestowed on – была дарована

## “Muride”

This element, unusual in many respects, was the last of the natural halogens to be discovered (if, of course, we accept the discovery of fluorine by Scheele in 1771).

On an autumn day in 1825, the following event took place in the laboratory of L. Gmelin, a professor of medicine and chemistry at Heidelberg University. A student by the name of C. Lowig brought to his teacher a thick-walled flask with an evil-smelling reddish brown liquid. Lowig told Gmelin that in his native town of Kreiznach he had studied the composition of water from a mineral spring. Gaseous chlorine turned the mother solution red. Lowig extracted with ether the substance that caused the colouring of the solution. It was a reddish brown liquid known subsequently as bromine. Gmelin showed great interest in his student's work and advised him to prepare the new substance in greater amounts and to study its properties in detail. It was a reasonable piece of advice since Lowig had little experience as an experimenter; but the work required time and the time factor turned against the student.

While he was assiduously preparing new portions of bad-smelling reddish brown liquid, a large article appeared in the *Annales de chimie et de physique*. The article was entitled "Memoir on a Specific Substance Contained in Sea Water" and was written by A. Balard. He was a laboratory assistant at a pharmaceutical school in the French town of Montpellier. The properties of his "specific substance" turned out to be quite similar to those of the reddish brown liquid obtained by Lowig. A. Balard wrote that in 1824 he began to study vegetation of salt marshes[1]. He subjected marsh grasses to the action of various chemical reagents trying to extract useful compounds from them. He prepared a mother solution which turned brown under the action of some reagents, such as chlorine. Then A. Balard studied an alkaline solution obtained after the treatment of sea algae ash[2]. As soon as chlorine water and starch were added to the solution, it separated into two layers. The lower part was blue and the upper one, reddish brown. A. Balard decided that the lower layer contained iodine which coloured starch blue. And what about the upper layer? Balard assumed that it contained a compound of chlorine with iodine. He tried to extract it but in vain[3]. Only after that did the laboratory assistant from Montpellier dare to think that reddish brown colouring was caused by a new chemical element. Balard separated the reddish brown liquid, which was similar to that separated several months before by the unknown student Lowig who later became an Academician and Professor at Sorbonne.

Balard gave the new element a prosaic name ―muride‖ from the Latin *muria* for ―brine‖[4]. He had an equally prosaic view of the nature of the element believing it to be the only non-metal liquid at room temperature like metallic mercury, which is liquid under the same conditions.

Balard's article did not remain unnoticed but, nevertheless, his friends advised him to send a report to the Paris Academy of Sciences. Balard followed the advice and on November 30, 1825, he sent a communication[5] ―Memoir on a Specific Substance Contained in Sea Water‖. The most important thing in the communication was the observation on similarity of muride with chlorine and iodine. The members of the Academy did not take such reports on trust[6] and a special committee was set up to check Balard's experimental results. The committee, consisting of Gay Lussac, Vauquelin, and Thenard, confirmed all the results obtained by Balard and only the name of the new element caused objections. The committee named it ―bromine‖ from the Greek *bromos* which means "stinking". The committee made its ruling[7] on August 14, 1826; the discovery of bromine was extremely important for chemistry.

And only one scientist met the news of the discovery with irritation. He was J. Liebig. Several years earlier he had received a bottle with a liquid from a German firm that asked Liebig to identify the liquid. The scientist did not analyse it thoroughly and made a hasty conclusion that the liquid was a compound of iodine with chlorine. When Liebig learnt about Balard's discovery he analysed the liquidremaining in the bottle and established that it was bromine. His contemporaries reported that Liebig said in temper[8]: ―It is not Balard who discovered bromine but bromine that discovered Balard.

***Notes:***

1. salt marshes – солевые болота
2. sea algae ash – зола морских водорослей
3. in vain – напрасно, тщетно
4. brine – соляной раствор, морская вода, рассол
5. communication – сообщение, информация
6. did not take … on trust – не приняла … на веру
7. ruling – решение
8. in temper – раздраженно

## Тексты для перевода по теме 3.3 «Документация в химической лаборатории»

### Chromatography Column

Chromatography columns are used in pharmaceutical and petroleum industries, environmental sciences, and toxicology to test for impurities or toxins.

*Range of chromatography columns*

There are several different types of chromatography columns including gas chromatography, low pressure or high pressure liquid chromatography, those with a dry stationary phase, and chromatography columns with a wet stationary phase.

*How do you use column chromatography?*

Chromatography columns are used to separate out individual components of a liquid sample. A chromatography column is in essence a tube filled with a solid substance (the stationary phase) through which the liquid sample (the mobile phase) passes. Because of molecule size and polarity, different components get through the column at different rates. The sample is then collected in small volumes and analyzed for content.

The size of the chromatography column, the substance that makes up the stationary phase, and the temperature range you will be working with all need to be taken into consideration when choosing a chromatography column.

Always follow the manufacturer’s instructions when installing columns. For gas chromatography columns in particular, remember that glass or fused capillary columns are fragile: handle them with care and wear safety glasses to protect eyes from flying particles while handling, cutting, or installing capillary columns.

Degas the eluent fully to prevent the formation of air bubbles. Presence of small debris or insoluble substances may result in deterioration of the column and/or they appear as noise on the chromatograms. Filter the eluent with a 0.45-μm disposable filter to prevent the problems.

For HPLC columns, the working pressure of the column should never exceed that recommended by the manufacturer. In general, you will always want to allow cooling time before changing columns.

*What are other hazards?*

The other hazards associated with column chromatography would be the hazards innate to the products and solvents used in this process. These hazards can include flammability, irritation, and various other health hazards depending on the solvent(s). The media can also present a hazard, such as silica being a skin/eye irritant, as well as a respiratory irritant due to the dust.

### Mtops MS300HS Hot Plate Magnetic Stirrer: Operating Conditions

This manual is designed to assist you in optimal usage of your new hot plate, stirrer or hotplate stirrer.

**Operating Conditions**

Your Mtops hot plate, stirrer or stirring hot plate is a general purpose heating and/or stirring plate designed for laboratory procedures requiring precise control of temperature and/or stirring speed. Your hot plate, stirrer or stirring hot plate has the following properties:

1. Ceramic-coated top plate: Ceramic coated top plate is corrosion proof, temperature resistant and resists aggressive fluids.
2. Coated in a pure white plate allows for easy observation of sample color change during use.
3. The top plate allows for quick thermal conduction and uniform surface temperature.
4. This device uses an electronic Analog temperature controller to control temperature
5. The Mtops Hot Plate Stirrers were designed to start and stop smoothly to prevent fluid spill over from rapid turnover and decoupling of stir bar.
6. The Mtops hot plate has an electronic feedback control which will accurately maintain temperature.

Mtops hot plates, stirrers, and stirrer/hot plates are designed to provide safe functioning under the following conditions:

- Indoor use
- Altitude up to 2000 meters (6,500 feet)
- Ambient temperatures of 0°C to 40°C
- Product should be placed on a flat surface at least 30.5 cm (12″) from walls, 122 cm (48″) from ceilings, and 30.5 cm (12″) from other hot plates if using multiple units.
- Maximum relative humidity of 85% for temperatures up to 31°C, decreasing linearly to 50% relative humidity at 40°C.
- Pollution Degree 2: Any foreign matter that may accumulate on or within the product during normal use is not electrically conductive.
- Installation Category II: Product is designed for connection to an electrical branch circuit inside a building with main supply voltage fluctuations not exceeding ±10% of the nominal voltage.

## Magnetic Stirrer

A magnetic stirrer is laboratory equipment that uses a rotating magnetic field to mix one or more solutes with a solvent in an automated way. It is considered the most widely used type of stirrer, since it is silent, efficient and does not have direct contact with the sample.

This electronic device is commonly used in food manufacturing and chemical research, as well as in research laboratories.

*How is a magnetic stirrer composed?*

This type of mixer is made up of a plate with a magnet or a series of electromagnetics, arranged in a circular shape at the bottom, which create a rotating magnetic field.

The size and shape of the magnetic bar determine the effectiveness of the stirring process, considering a constant speed. Some models of magnetic stirrers also have a heating system – some reach up to 300ºC – to heat the samples at the same time as they are stirred.

*Types of magnetic stirrers*

- Magnetic stirrers without heating: Useful, if you simply want to stir a sample.
- Heated magnetic stirrers: Very useful when, in addition to shaking the sample, you also need to heat it.
- Magnetic stirrers with heating and temperature probe: Necessary when you need to know the temperature at which the sample is.
- Timer magnetic stirrers: If a solution needs to be stirred for an exact amount of time and the stirring stops automatically at the end of an experiment.
- Multiple magnetic stirrer: Useful when you need to shake several containers at the same time and at the same speed.

*Uses of a Laboratory Magnetic Stirrer*

When using the magnetic stirrer you must place the flask or beaker ready with the content of the solution that you are going to stir on the stirring plate, then insert the magnetic bar into the container and then turn on the device, adjust the speed .

Starting with the slowest speed to increase it progressively you will get the result you want. You must control that the liquid does not spill in the process and when the stirring is finished, remember to return the device to its initial speed and turn off the equipment, finally remove the stirring bar from the container.

## Vacuum Filtration System

A vacuum filtration system is a laboratory setup used to separate solid particles from a liquid or gas. It consists of a pump that creates a vacuum, a filter flask, a filter funnel, and a filter medium. The liquid or gas is drawn through the filter medium by the vacuum, and the solid particles are retained on the filter. The process is used to purify or concentrate samples in a variety of applications, including chemical analysis, quality control, and research.

### *Chemical Resistant Laboratory Vacuum Pump*

A chemical resistant laboratory vacuum pump is a type of pump that is specifically designed to handle corrosive or abrasive chemicals without degrading or failing. These pumps are typically made of materials that are resistant to chemical attack, such as stainless steel or fluoropolymers.

### *Application of Chemical Resistant Laboratory Vacuum Pump*

Chemical resistant laboratory vacuum pumps are used in a variety of applications. Some common examples include:

*Filtration:* Chemical resistant vacuum pumps can be used to draw a liquid or gas through a filter medium to separate solid particles. This process is often used to purify or concentrate samples in the laboratory.

*Evaporation:* Vacuum pumps can be used to remove solvents from a solution by evaporating them under reduced pressure. This is a common technique in the pharmaceutical and chemical industries.

*Degassing:* Vacuum pumps can be used to remove dissolved gases from liquids or gases. This process is used to purify samples or to remove gases that may interfere with chemical reactions.

*Sample preparation:* Chemical resistant vacuum pumps are often used in the preparation of samples for analysis. For example, they may be used to remove water from a sample to make it easier to analyze or to concentrate a sample by removing solvent.

*When dealing with vacuum pumps, keep the following in mind*:

- Always use the pump in a dry and well-ventilated area.
- Keep the power cord safely when the pump is not in use.
- Do not forget to inspect the plug, cord, or hose for signs of damage before using the pump.
- A big plus point of this pump is it does not require lubrication.

## Automated Titrator

A titrator determines the amount of a substance, or analyte, which is dissolved in a sample. Through a controlled addition of reagent in a known volume, the chemical reaction is monitored either by colour change with a photometric sensor or with a suitable pH, redox, conductivity or surfactant sensor.

Although manual titration is used about 60% of the time, automated titration is growing in popularity due to several key advantages. A completely automated system delivers improved accuracy, repeatability, safety, traceability, and it also meets regulatory requirements while freeing up valuable employee time.

Without the development of sensors, it wouldn’t be possible to establish automated titration. The first glass electrode for potentiometric titration was manufactured in 1909. Potentiometric sensors give an endpoint or equivalence point determination separate from colour change or bias from a user.

As numerous samples need different electrode properties, there are now a large number of sensors that are accessible to be able to do this. Examples of the different types of titration are listed in Table 2.

The Optrode is one sensor that must get a specific mention when investigating automating titrations. Titrations with colour indications are still frequently used, so developments began to create the Optrode.

It is a sensor that can identify minute colour differences by defining the change in absorbance at a particular wavelength. It then converts the absorption into a potential that can be measured. In such a way, colorimetric titrations also develop to be increasingly accurate and precise. The increased accuracy is because results no longer depend on the visual perception of laboratory users.

Manual titration methods involve all results being read from the burette and documented in the lab journal or typed manually into the software. This process poses error risk, with an increased likelihood of incorrect value transfer.

The highest cost of any manual titration is the cost of labour. Laboratory analysts need to be suitably trained and, during titration, are fully occupied. With automated titrations, on the other hand, this completely changes. The procedure on the autotitrator is programmed one time, and can then be recalled whenever needed by any member of personnel simply by pushing a button.

## Micropipettes

The ability to measure very small amounts, microliters (µl), of liquid chemicals or reagents is a fundamental skill needed in the biotechnology or research lab. Scientists use a device called a micropipette to measure these very small volumes with accuracy.

There are several sizes of micropipettes used in the biotechnology lab. Most commonly, one will find P-1000, P-200, and P-10 micropipettes in the laboratory. The P-1000 measures volumes between 100-1000 µl, the P-200 measures volumes between 20-200 µl, and the P-20 measures volumes in the 0.5-10 µl range.

Each micropipette has a similar but different display window. For the P1000, the red number indicates the thousands place, followed by the hundreds, tens, and the ones displayed as small vertical lines.

*To use a micropipette:*

1. Set the dial to the desired volume.
2. Hold the micropipette in your dominant hand, and gently but securely place the end of the micropipette into the proper size tip (blue for P-1000, clear for P-10, and yellow for all other sizes). Once the tip is on, be careful *not to touch the tip on anything!* If your tip touches the bench, lab coat etc. eject the tip into the waste container and get a new clean pipet tip.
3. Push the micropipette plunger down to *the first stop and hold your thumb in this position.*
4. Place the pipet tip into the solution you are measuring out.
5. Gently release your thumb from the plunger to draw fluid into the tip.
6. Confirm that the tip has liquid and that no bubbles are present within the tip.
7. Gently touch the tip to the center of the circle labeled 5 µL and slowly push all the way down (to second stop) on the plunger to dispense the liquid.
8. Dispose of the tip properly after you are done measuring that liquid.

Remember, as with all fine motor skills, this new skill will require practice and determination. Be sure to operate the micropipette slowly and carefully, particularly since these are delicate, costly instruments.

## Lab Microscope

A microscope is a laboratory instrument used to examine objects that are too small to be seen by the naked eye.

*Problems:*

Certain mechanical difficulties, real or apparent, may be encountered while operating your microscope.

A common problem is the failure of the fine adjustment to turn in the direction required for sharp focusing. This indicates that it has been screwed to the limits of its threads, either upward or downward, as the case may be. Screw it back to about one-half the thread distance, use the coarse adjustment to raise or lower the objective sufficiently to bring the specimen into view, and then refocus with the fine adjustment.

If the coarse adjustment fails to lower the objective sufficiently to bring the specimen into view, the fine adjustment has been screwed up too far and should be screwed down to about half its thread distance.

Any other problems? Burned-out light bulb? Focus knobs difficult to turn, grinding as they move, or moving by themselves? Specimen going in and out of focus as the stage is moved? Did you write the word "up" on your microscope slide? Is it still facing up? *Do not attempt to fix these yourself. Get your instructor.*

*Proper Care of the Microscope:*

The compound microscope used in microbiology is a precision instrument. Its mechanical parts, such as the calibrated mechanical stage and the adjustment knobs, are easily damaged and all lenses, particularly the oil immersion objective, are delicate and expensive. Thus, the instrument must be handled with care. The following rules, cautions, and maintenance should be observed:

1. Use both hands when carrying the microscope; one firmly grasping the arm of the microscope, the other beneath the base. Avoid sudden jars.
2. To keep the microscope and lens systems clean:

- Never touch the lenses. If the lenses become dirty, wipe them gently with lens paper.
- Never leave a slide on the microscope when it is not in use.
- Always use lens paper to remove oil from the oil-immersion objective after its use. *Do not* wipe the lower power objectives with the same piece of lens paper used to clean the oil-immersion objective. If by accident oil should get on either of the lower power objectives, wipe it off immediately with clean lens paper.
- Keep the stage of the microscope clean and dry.

## Pipet Fillers

A pipet filler is a laboratory tool used to fill pipets with liquids. To use this, we will first fit onto the top of the pipet a pipet filler. This controls the flow of liquid in and out of the pipet.

Regardless of the type of pipet filler, please try not to allow liquid to enter the pipet filler or it will contaminate the liquid.

*Dial Type Pipet Fillers*

These are relatively simple to use; however, it is important to note that these are color-coded to match the volume of the pipet you are trying to fit. Sometimes intermediate sized pipets do not fit these fillers.

Blue: 2 mL
Green: 10 mL
Red: 25 mL

To use this type of pipet filler:

Fit the pipet filler on top of the pipet

Depress the plastic plunger completely.

When the pipet tip is submerged completely in the liquid, use the rotary dial to raise the plunger level. Fill the pipet up until the bottom of the meniscus matches the calibration mark on the pipet.

Move the pipet so that it is on top of the container into which the liquid is to be dispensed, and depress the plunger.

*Three-Valve Pipet Fillers*

The other two types of pipet fillers are generally usable with all pipets regardless of size; however, their use is more complex. One type that is used has a rubber bulb and three buttons (rubber circles) labeled with letters.

To use this type of pipet filler

Fit the pipet filler on top of the pipet.

Depress button A and squeeze out the air from the rubber bulb.

Place the pipet tip into the liquid to be measured, and then press the “S” button to suck the liquid into the pipet.

Move the pipet into the receiving vessel and press the “E” button to release the liquid.

*Single-Bulb Pipet Filler*

The last type of pipet filler that is found looks like a larger version of a single bulb. To use this, squeeze out the air from the pipet bulb and place the bottom of the bulb firmly on top of the pipet. After this, place the pipet tip in the liquid sample and release the bulb slowly to allow the liquid to rise slowly until the bottom of the meniscus meets the graduation desired.  At that point, quickly remove the pipet bulb and use your finger to block the top of the pipet.  Move the pipet above the container into which you plan to dispense the liquid and release the finger. With this type of pipet filler, quite often you will either overshoot or undershoot.  You will often need to re-pipet the solution multiple times.