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Английский язык для химиков-технологов

Учебно-методический комплекс
Часть I: практикум
Часть II: грамматический минимум, справочные материалы, глоссарий

Под редакцией Т.И. Кузнецовой

Допущено Учебно-методическим объединением по химико-технологическому образованию в области химической технологии и биотехнологии в качестве учебного пособия для подготовки бакалавров, магистров и дипломированных специалистов высших учебных заведений, обучающихся по химико-технологическим направлениям: «Химическая технология и биотехнология», «Энерго- и ресурсосберегающие процессы в химической технологии и биотехнологии»

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Цель комплекса – обучение студентов вузов навыкам письменной речи, развитие умений читать литературу по специальности. Комплекс включает 2 части. Часть I содержит тематические тексты, заимствованные из оригинальной научно-технической литературы, которые в учебных целях несколько сокращены и адаптированы, снабжены пояснениями и комментариями, различные предтекстовые и послетекстовые упражнения, а также блок дополнительных лексических и грамматических заданий для расширения лексической и грамматической базы и направленный на развитие и совершенствование переводческих навыков. Часть II включает Грамматический справочник-минимум, практический словарь-минимум (глоссарий) и справочные материалы, которые могут быть использованы при работе с тематическими текстами части I данного учебного комплекса во время работы в аудитории и при самостоятельной подготовке.

Учебно-методический комплекс создан в соответствии с Федеральными государственными стандартами по направлениям подготовки: «Химическая технология и биотехнология», «Энерго- и ресурсосберегающие процессы в химической технологии и биотехнологии».

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ПРЕДИСЛОВИЕ

Знание английского языка как языка международного общения диктуется задачами сегодняшнего дня. Россия укрепляет научные, торговые и культурные связи с зарубежными странами. Во многих профессиях неизбежно приходится сталкиваться с необходимостью общения на английском языке и использования англоязычной литературы в работе по своей специальности. Это в полной мере относится и к химической отрасли знаний со своей терминологической номенклатурой. Специалист-химик должен уметь читать специальную литературу и переводить тексты химико-технологической направленности.

Предлагаемый учебно-методический комплекс представляет собой практико-теоретический курс, основной целью которого является стимулировать письменную и устную речь студентов химико-технологических вузов, а также развить их переводческие компетенции.

Настоящий комплекс создан в соответствии с Федеральными государственными стандартами по направлениям подготовки: «Химическая технология и биотехнология», «Энерго- и ресурсосберегающие процессы в химической технологии и биотехнологии».

СТРУКТУРА УЧЕБНО-МЕТОДИЧЕСКОГО КОМПЛЕКСА

Комплекс разделен на две части.

Часть I
Практикум

Практикум состоит из трех блоков:

- основной курс,
- лексико-грамматический блок,
- аннотирование и реферирование.

Основной курс

Построен по тематическому принципу и состоит из 12 тематических уроков и обзорного урока. Каждый урок включает 5 разделов:

- предтекстовые упражнения,
- базовый текст,
- послетекстовые упражнения,
- дополнительные тексты для перевода с листа,
- контрольный перевод.

Содержание уроков следующее:

Урок 1. *Грамматика*: Группа настоящих времен. *Тема*: Chemistry.

Урок 2. *Грамматика*: Группа будущих времен. *Тема*: Science and Scientific Methods.

Урок 3. *Грамматика*: Группа прошедших времен. *Тема*: Discoveries in the Past.

Урок 4. *Грамматика*: Согласование времен. Условные предложения. *Тема*: Science of Tomorrow.
Урок 5. *Грамматика*: Страдательный залог. *Тема*: Technology.
Урок 6. *Грамматика*: Причастие. *Тема*: Laboratory.
Урок 7. *Грамматика*: Независимый причастный оборот. *Тема*: Periodic Table.
Урок 8. *Грамматика*: Функции инфинитива. *Тема*: D.I. Mendeleev.
Урок 9. *Грамматика*: Инфинитивные комплексы. *Тема*: Chemical Plant.
Урок 10. *Грамматика*: Модальные глаголы. *Тема*: Forensic Chemistry.
Урок 11. *Грамматика*: Модальные слова. *Тема*: Ecology.
Урок 12. *Грамматика*: Сокращения. *Тема*: Pharmaceutical Chemistry.
Обзорный урок.

Лексико-грамматический блок.

Этот блок содержит серию специальных упражнений, направленных на расширение лексико-грамматической базы и состоит из:

1) Лексические упражнения,
2) Грамматические упражнения,
3) Сводные лексико-грамматические трудности.

Аннотирование и реферирование.

Данный блок содержит краткий теоретический материал по аннотированию и реферированию, а также подборку текстов различной тематики для развития практических навыков по составлению аннотаций и рефератов.

Часть II
Грамматический минимум
Справочные материалы
Глоссарий

Часть II включает Грамматический справочник – минимум, практический словарь-минимум (глоссарий) и справочные материалы, которые могут быть использованы при работе с тематическими текстами части I данного учебного комплекса во время работы в аудитории и при самостоятельной подготовке.

Справочные материалы содержат следующие разделы: таблицу химических элементов (раздел 1), правила чтения элементов, обозначений, формул неорганических соединений и уравнений химических реакций (раздел 2), правила чтения единиц измерения (раздел 3), наименования основных химических соединений (раздел 4) и перечень наименований основного химического оборудования (раздел 5).

МЕТОДИЧЕСКИЕ ПОЯСНЕНИЯ

Комплекс рассчитан на студентов, владеющих определенными навыками письменной и устной речи в объеме школьной программы, поэтому авторы не ставили своей целью исчерпывающее отражение всех аспектов английского языка. Основное внимание уделяется лексико-грамматическим средствам английского языка, наиболее часто встречающихся в технической литературе в целом и, в том числе, в текстах химико-технологической направленности.

Материалы комплекса ориентированы на систематизацию знаний по лексике изучаемой темы и грамматических явлений, представляющих наибольший интерес. Увязывание лексики с определенными грамматическими структурами и конструкциями является одним из важнейших принципов развития как письменной, так и устной речи, поскольку умение говорить и писать на иностранном языке, а также переводить с иностранного языка на родной и с родного на иностранный подразумевает не столько знание отдельных слов, сколько умение правильно использовать их в соответствующих структурах. Многочисленные упражнения пособия подчинены именно этой цели.

Переводческий аспект данного комплекса предполагает ознакомление студентов с основными принципами перевода. Студенты должны овладевать специальной терминологией на русском и английском языках и использовать в переводе взаимно эквивалентные терминологические единицы.

Часть I (практикум) учебно-методического комплекса условно разделена на 12 уроков, однако это не означает, что материал каждого урока должен быть пройден за одно занятие. Преподаватель может отобрать лишь то, что ему представляется наиболее рациональным для данной аудитории, учитывая ее языковые возможности.

Комплекс рассчитан на 180 часов аудиторных занятий. В зависимости от условий (количество часов, количество студентов в группе, уровень языковой подготовки студентов, целевая установка и т.д.), обучение с помощью комплекса может проводиться либо под полным, либо под частичным контролем преподавателя. Материалами комплекса можно воспользоваться при проведении дополнительных или самостоятельных занятий.

Для заметок

Основной курс

Урок 1
Modern Chemistry

I. Предтекстовые упражнения

1. Вспомните, какими временными формами можно передать *настоящее время* при переводе с русского языка на английский язык. (Приложение 1, §§ 1, 2)

2. На основе предложений из текста проанализируйте употребление Present Simple, Present Continuous, Present Perfect Continuous:

=> Society *provides* an important part of the solution to needs in chemistry. (Present Simple)

=> They *are contributing* to a new area. (Present Continuous)

=> For decades chemists *have been finding* applications for renewable matter. (Present Perfect Continuous)

3. Раскройте скобки, поставив глагол в Present Simple, Present Continuous, Present Perfect Continuous:

=> They still (to work) at this problem.

=> They (to work) at this problem since 2010.

=> They (to work) sometimes at this problem.

4. Найдите ошибки в употреблении Present Simple, Present Continuous, Present Perfect Continuous и исправьте их:

=> They have been routinely working at this problem.

=> They work at this problem now.

=> They are working at this problem for two years.

5. Определите правильное место в предложении для находящегося в скобках слова:

There is a need for the educated chemist who can work on the core topics. *(broadly)*

6. Выберите правильное слово:

Oil is not an *indefinite/infinite* resource.

7. Вставьте пропущенное слово:

This area will lead to the next … of medicines.

8. Образуйте двучленную номинативную конструкцию, объединив существительное *drug* с одним из следующих существительных:

drug — energy
drug — biology
drug — discovery

9. Выберите правильный ответ на следующий вопрос:

What is Chemical Biology?

- Chemical Biology is the study and manipulation of molecules or matter.
- Chemical Biology is the study of the chemistry of life and medicine.

10. Найдите в словаре перевод следующих однокоренных слов:

=> chemical, chemically, chemicalize, chemicalization, chemist, chemistry.

=> biologic, biological, biologism, biologist, biologize, biology.

II. Текст

1. Запомните следующие слова и словосочетания

absorption	combination	to envisage
accompany	compound	explosive
behaviour	density	hardness
colour	determination	heat
composition	drug discovery	infinite resource
interaction	particularly	bond
matter	to find (found, found)	environmentally friendly
molecule	application	environment
property	to find out	source of energy
solution	development	material
study (n)	dye	as well as
to contribute to	to create	renewable matter
to provide	fiber	broadly educated
to undergo (underwent, undergone)	to lead (led, led)	waste (n)
	medicine	to minimise waste

2. WHAT IS CHEMISTRY?

Chemistry is the study and manipulation of molecules or matter, its structure, properties, and composition, and the changes that matter undergoes. Chemists routinely create new matter that finds applications in computing, nanotechnology, biotechnology, drug discovery, biology and medicine. Chemists are environmentally friendly, working to find new sources of energy and to minimize waste. For decades chemists have been finding applications for renewable matter which is important because oil is not an infinite resource. They are contributing to a new area – Chemical Biology – which is the study of the chemistry of life and medicine. It is envisaged that this area will lead to the next generation of medicines. Chemistry provides an important part of the solution to needs in society and can provide opportunities and the knowledge for economic development. There is a need for the broadly educated chemist who can work on the core topics as well as those who can work and communicate with biologists, physicists, clinicians and engineers. The science of chemistry is of prime importance to nanotechnology, biotechnology, drug discovery, the environment, energy, biology and medicine.

The work of chemists is all about you. The toothpaste you use in the morning is the work of chemists. Chemists had much to do with the clothing you wear. They may have made the fiber or created the dye that gives it colour. From the test tubes of chemists have come modern medicines and many kinds of vitamins. It is the chemist who deserves thanks for many of the materials you find in your home, at school, and in cars, buses, planes, and trains.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. What is chemistry?
2. Who creates new matter?
3. Where does new matter find applications?
4. What is the aim of the chemists' work?
5. Why is renewable matter important?
6. Is oil an infinite resource?
7. Chemical Biology is the study of the chemistry of life and medicine, isn't it?
8. What can chemistry provide?
9. Is there a need for the broadly educated chemist?
10. Is the science of chemistry of prime importance to other sciences?
11. Can you give an example of the work of chemists?
12. Where is it possible to find the materials created by chemists?

2. Обратите внимание на сочетаемость слова *chemistry* с другими словами для образования различных терминов и дайте русские эквиваленты этих терминов:

agricultural analytical applied capillary crystal computational forensic green medicinal nuclear organic (inorganic) quantum pharmaceutical radiation tracer	chemistry

3. Расшифруйте следующие сокращения и переведите их на русский язык. Проверьте себя по ключу (Приложение 6).

сокращение	развёрнутая форма	перевод
chem.		
biol.		
mol.		
mol. wt.		

4. Вспомните, какие существительные (всего три) употреблены в тексте в сочетании с прилагательным *new*. Проверьте себя по тексту.

new ~

new ~

new ~

IV. Дополнительные тексты для просмотрового[1] чтения с последующим переводом с листа

CHEMISTRY DISCIPLINES

There is a vast literature on chemistry. It covers the structure of substances, how they combine to create other substances and how they react under various conditions, etc. Chemistry is divided into a lot of sections. There are more than thirty branches (disciplines) of chemistry today. The areas covered by these sections are explained below:

General Chemistry - General chemistry examines the structure of matter and the reaction between matter and energy. It is the basis for the other branches of chemistry.

Physical chemistry covers the structures, properties and behaviour of substances, includes the basic laws of chemistry.

Inorganic chemistry looks at the groups of elements in the periodic table, their properties, uses and compounds (excepting carbon compounds).

Organic chemistry covers the carbon-chain compounds, examines their structures and various groups into which they fall. This branch of chemistry deals with the chemistry of carbon and living things.

Environmental chemistry explains the interaction of naturally-occurring chemicals, and the effect of pollution.

General chemistry information is a section of charts and tables of properties, symbols and means of identification, plus information on apparatus, preparations, tests and forms of chemical analysis.

Agrochemistry - This branch of chemistry may also be called agricultural chemistry. It deals with the application of chemistry for agricultural production, food processing, and environmental remediation as a result of agriculture.

Analytical Chemistry - Analytical chemistry is the branch of chemistry involved with studying the properties of materials or developing tools to analyze materials.

Astrochemistry - Astrochemistry is the study of the composition and reactions of the chemical elements and molecules found in the stars and in space and of the interactions between this matter and radiation.

Biochemistry - Biochemistry is the branch of chemistry concerned with the chemical reactions that occur inside living organisms.

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[1] *Просмотровое чтение* – вид чтения, которым пользуются для того, чтобы получить самое общее представление о содержании в целом, чтобы понять в самых общих чертах, о чем данный текст.

Chemical Engineering - Chemical engineering involves the practical application of chemistry to solve problems.

Chemistry History - Chemistry history is the branch of chemistry and history that traces the evolution over time of chemistry as a science. To some extent, alchemy is included as a topic of chemistry history.

Cluster Chemistry - This branch of chemistry involves the study of clusters of bound atoms, intermediate in size between single molecules and bulk solids.

Combinatorial Chemistry - Combinatorial chemistry involves computer simulation of molecules and reactions between molecules.

Electrochemistry - Electrochemistry is the branch of chemistry that involves the study of chemical reactions in a solution at the interface between an ionic conductor and an electrical conductor. Electrochemistry may be considered to be the study of electron transfer, particularly within an electrolytic solution.

Food Chemistry - Food chemistry is the branch of chemistry associated with the chemical processes of all aspects of food. Many aspects of food chemistry rely on biochemistry, but it incorporates other disciplines as well.

Geochemistry - Geochemistry is the study of chemical composition and chemical processes associated with the Earth and other planets.

Green Chemistry - Green chemistry is concerned with processes and products that eliminate or reduce the use or release of hazardous substances. Remediation may be considered part of green chemistry.

Kinetics - Kinetics examines the rate at which chemical reactions occur and the factors that affect the rate of chemical processes.

Pharmaceutical (Medicinal) Chemistry - Pharmaceutical chemistry is chemistry as it applies to pharmacology and medicine.

Nanochemistry - Nanochemistry is concerned with the assembly and properties of nanoscale assemblies of atoms or molecules.

Nuclear Chemistry - Nuclear chemistry is the branch of chemistry associated with nuclear reactions and isotopes.

Photochemistry - Photochemistry is the branch of chemistry concerned with interactions between light and matter.

Polymer Chemistry - Polymer chemistry or macromolecular chemistry is the branch of chemistry that examines the structure and properties of macromolecules and polymers and finds new ways to synthesize these molecules.

Solid State Chemistry - Solid state chemistry is the branch of chemistry that is focused on the structure, properties, and chemical processes that occur in the solid phase. Much of solid state chemistry deals with the synthesis and characterization of new solid state materials.

Thermochemistry - Thermochemistry may be considered a type of Physical Chemistry. Thermochemistry involves the study of thermal effects of chemical reactions and the thermal energy exchange between processes.

Theoretical Chemistry - Theoretical chemistry applies chemistry and physics calculations to explain or make predictions about chemical phenomena.

Materials Science and Technology is the study of materials, nonmetallic as well as metallic, and how they can be adapted and fabricated to meet the needs of modern technology. Using the laboratory techniques and research tools of physics, chemistry, and metallurgy, scientists are finding new ways of using plastics, ceramics, and other nonmetals in applications formerly reserved for metals.

GENERAL CHEMISTRY

General chemistry examines the structure of matter and the reaction between matter and energy. General chemistry is the science of matter, especially its chemical reactions, but also its composition, structure and properties. Chemistry is concerned with atoms and their interactions with other atoms, and particularly with the properties of chemical bonds. It is the basis for the other branches of chemistry. Chemistry studies experimentally and theoretically the composition of matter and the changes that take place in matter. A chemical change involves changes in composition and in properties. A physical change involves only changes in properties with no change in composition.

Chemical changes are usually accompanied by the liberation or the absorption of energy in the form of light, heat or electricity. All forms of matter consist of either pure substances or mixtures of two or more pure substances. Elements are the building blocks of matter. Compounds are combinations of elements. Most of the elements are metals and most of them will unite with other elements and form compounds. The formation of a compound from simpler substances is known as synthesis. Analysis is the process of breaking down a compound into simpler substances or its elements and thus is the determination of its composition. The composition of a pure substance never changes.

Every substance has physical and chemical properties. Physical properties include colour, smell, solubility, density, hardness and boiling and melting points. Chemical properties include the behaviour with other materials. Matter exists in three states: the solid, the liquid and the gaseous state. A substance can be transformed from one state to another under the changes of its temperature.

ORGANIC CHEMISTRY

Organic chemistry is a branch of chemistry that deals with the structure, properties, and reactions of compounds that contain carbon. It is a highly creative science. Organic chemists can create new molecules never before proposed which, if carefully designed, may have important properties for the betterment of the human experience. Organic chemistry is the largest chemistry discipline.

Beyond our bodies' DNA, peptides, proteins, and enzymes, organic compounds are all around us. They are central to the economic growth of the U.S., in industries such as the rubber, plastics, fuel, pharmaceuticals, cosmetics, detergents, coatings, dyestuffs, and agrichemicals industries. The very foundations of biochemistry, biotechnology, and medicine are built on organic compounds and their role in life processes. Most of all the modern, high tech materials are composed, at least in part, of organic compounds. Clearly, organic chemistry is critically important to our high standard of living.

Organic chemists at all degree levels are found in all those industries, working on projects from fundamental discovery to highly applied product development. The foundation of the pharmaceutical industry is the large pool of highly skilled organic chemists. For example, nature may provide a molecule such as a complex antibiotic, an antitumor agent, or a replacement for a hormone such as insulin; organic chemists determine the structure of this newly discovered molecule and then modify it to enhance the desired activity and specificity of action, while decreasing undesired side effects. Indeed, organic chemists have produced a wonderful myriad of highly successful products to fight human diseases.

There is tremendous excitement and challenge in synthesizing a molecule never before made synthetically or found in nature. Tailoring the properties of that molecule via chemical synthesis to produce beneficial effects to meet the needs of the present and future human existence is both challenging and rewarding.

BIOCHEMISTRY

Biochemistry is the science of the molecular basis of life. It involves the study of the rich variety of molecules found in living cells and organisms.

The objective of biochemistry is to understand how these molecules work by observing how they operate and interact. The scope of biochemistry is as wide as life itself. Biochemists study the molecular processes going on in all types of organisms from bacteria to plants, and from yeasts to fish, birds and animals.

The exciting revolting underway with the sequencing of the human and other genomes, along with many new nano-scale technologies, is allowing biochemists to study life in ever more detail.

This new insight into life is rapidly advancing our understanding of the molecular choreography underlying growth and development. It also provides new openings for applying our knowledge of the molecules of life in the diagnosis and treatment of many diseases. Graduates in biochemistry find jobs in the biotechnology and pharmaceutical industries, biomedical laboratories, the agribusiness sector, scientific policy making, and also go on to further research for Masters and PhD degrees, or other postgraduate qualifications.

INORGANIC CHEMISTRY

Inorganic chemistry is the study of the synthesis and behaviour of inorganic and organometallic compounds. This field covers all chemical compounds except the myriad organic compounds (carbon based compounds, usually containing C-H bonds), which are the subjects of organic chemistry. The distinction between the two disciplines is far from absolute, most importantly in the subdiscipline of organometallic chemistry. It has applications in every aspect of the chemical industry including catalysis, materials science, pigments, surfactants, coatings, medicine, fuel, and agriculture.

Many inorganic compounds are ionic compounds, consisting of cations and anions joined by ionic bonding. Important classes of inorganic salts are the oxides, the carbonates, the sulfates and the halides. Many inorganic compounds are characterized by high melting points. Inorganic salts typically are poor conductors in the solid state. Other important features include their solubility in water and ease of crystallization. Where some salts (e.g., NaCl) are very soluble in water, others (e.g., SiO_2) are not.

The simplest inorganic reaction is double displacement when in mixing of two salts the ions are swapped without a change in oxidation state. When one reactant contains hydrogen atoms, a reaction can take place by exchanging protons in acid-base chemistry. Inorganic compounds are found in nature as minerals. Soil may contain iron sulfide as pyrite or calcium sulfate as gypsum. The first important man-made inorganic compound was ammonium nitrate for soil fertilization.

Subdivisions of inorganic chemistry are organometallic chemistry, cluster chemistry and bioinorganic chemistry. These fields are active areas of research in inorganic chemistry, aimed toward new catalysts, superconductors, and therapies.

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

MODERN RULES

The IUPAC's main responsibility is to decide how chemicals are to be named, and also to assign credit to the chemists who found them first. It publishes them in books, coded by colour.

The Gold Book is for all the jargon that chemists use. The Green Book is about symbols and units of measurement. The Red Book is for elements and inorganic compounds. The Blue Book is for organic chemicals like benzene and alcohol.

IUPAC also puts together books that all chemists need as reference material, like lists of melting points, solubility of different things in water, standard methods for doing experiments and a lot more. Many of these books take a lot of hard work over many years.

CHEMISTRY AND MATTER

-1-

Science plays such an important part in the modern world that no one can now feel that he understands the world in which he lives unless he has an understanding of science. The science of chemistry deals with substances. At this point in the study of chemistry we shall not define the word substance in its scientific sense, but shall assume that you have a general idea of what the word means. Common examples of substances are water, sugar, salt, copper, iron, oxygen – you can think of many others.

Nearly two centuries ago it was discovered by an English chemist, Sir Humphry Davy (1778-1827), that common salt can be separated, by passing electricity through it, into a soft, silvery metal, to which he gave the name sodium, and a greenish-yellow gas, which had been discovered some time earlier, and named chlorine. Chlorine is a corrosive gas, which attacks many metals, and irritates the mucous membranes of the nose and throat if inhaled. The discovery that the properties of common salt are quite different from those of sodium or chlorine is one of the many surprising facts about the nature of substances that chemists have found out.

A sodium wire will burn in chlorine, producing salt, the process of combination of sodium and chlorine to form salt being called a *chemical reaction.* When a mixture of gasoline and air explodes in the cylinders of an automobile a chemical reaction takes place, and at the same time the energy is released to move the automobile. Both carbon dioxide and carbon monoxide are compounds of carbon and oxygen, and water being a compound of hydrogen and oxygen.

-2-

Chemists study substances to learn as much as they can about their properties (their characteristic qualities) and about the reactions that change them into other substances. Knowledge obtained in this way has been found to be extremely valuable. Since some substances (like morphine and cocaine), may have undesirable properties along with the positive ones, we should test such substances for their powers of deadening pain and of producing addiction very thoroughly.

In the beginning, some methods carried out in laboratories were really dangerous, e.g. a young investigator, H. Davy tested many gases on himself by inhaling them. He discovered that one gas (named laughing gas), produced a state of hysteria when inhaled, and that people seemed not to suffer pain when they fell down or bumped into an object. It is rather surprising, but that gas was not suggested to be used in surgical operations right after its discovery. No one seems to have had this idea, and the use of anesthetics was delayed for nearly half a century. Then another investigator in the United States noticed that the chemical substance ether, when inhaled, produces unconsciousness, and another one noticed the same effect with chloroform. These substances were soon brought into general use. The discovery of anesthesia was a great discovery, not only because it relieves pain, but also because it permits delicate surgical operations to be carried out that would be impossible if the patients remained conscious. No doubt that the twentieth century may be called the chemical age.

CHEMICAL AND PHYSICAL CHANGES

Chemical change is a change that takes place in a substance, during which it breaks up into simpler substances or it combines with other substances to make a new one with different properties or characteristics. For example, mercuric oxide may be changed to mercury and oxygen by heating it; the burning of wood is an example of a chemical change in which the elements carbon and oxygen are combined to form the gas, carbon dioxide. A physical change is one in which the identifying characteristics or properties of the substance are not changed, although a change in form or state may occur. The melting of ice, the breaking of glass, or the dissolving of sugar in water are examples of physical changes.

In a chemical change where there is a chemical reaction, a new substance is formed and energy is either given off or absorbed. For example, if a piece of paper is cut up into small pieces it still is paper. This would be a physical change in the shape and size of the paper. If the same piece of paper is burned, it is broken up into different substances that are not paper. Physical changes can be reversed; chemical changes cannot be reversed with the substance changed back without extraordinary means, if at all. For example, a cup of water can be frozen when cooled and then can be returned to a liquid form when heated.

THE 1860 CONFERENCE

The 19th century was a time when there was a new chemical discovery almost every day. Sometimes, the same chemical would be found in labs in different countries, and get different names. For example, what was called phenol in Europe was called carbolic acid in England; the word alcohol may refer to a class of compounds or just ethyl alcohol. Is the chemical with symbol S spelt sulphur or sulfur? Because of this, it was decided that a committee of eminent chemists would help create some rules for giving chemicals their names.

The committee was headed by August Kekule, and called for a conference in 1860. They also decided to form a permanent association of chemists, where they could discuss all issues, not just names.

GENEVA RULES

In 1892, the first set of rules was finally agreed upon. They were adopted at Geneva, the venue for the meeting of the International Union of Chemistry. As more and more chemicals were being discovered (there are more than 50 million now), these Geneva Rules were not enough.

In 1911, chemists from around the world formed the International Association of Chemical Societies (IACS) at a meeting in Paris. This became the International Union of Pure and Applied Chemistry (IUPAC) in 1919.

Урок 2
Solving Scientific Problems

I. Предтекстовые упражнения

1. Вспомните, какими временными формами можно передать *будущее время* при переводе с русского языка на английский язык. (Приложение 1, §§ 1, 3)

2. Определите, какая из четырех форм будущего времени использована в тексте и проанализируйте ее употребление.

3. Раскройте скобки, поставив глагол в Future Simple, Future Continuous, Future Perfect, Future Perfect Continuous:

=> They (to solve) this problem by the end of the year.

=> By next year they (to solve) this problem for three years.

=> They (to solve) this problem next year.

=> They (to solve) this problem at 3 o'clock sharp.

4. Замените слова в скобках их английскими эквивалентами:

The (цель) of scientists is to (достигать) only (положительных) results from their work.

5. Определите правильное место в предложении для находящегося в скобках слова:

Most of the problems created by technology have arisen as side effects of beneficial technology. (*otherwise*)

6. Выберите правильное слово:

By studying these *datum/data/date*, scientists are able to state a scientific law.

7. Вставьте пропущенное слово:

Scientific laws describe natural events but do not … them.

8. Образуйте смысловые словосочетания, объединив прилагательное *pure* с одним из следующих существительных:

world
pure science
reason
plan

9. Определите лексические соответствия и используйте предложенную лексику при переводе:

observation	загрязнение
investigation	объяснение
explanation	сведения
information	наблюдение
pollution	исследование

10. Найдите в словаре перевод следующих однокоренных слов:

=> method, methodic (=methodical), methodically, methodize, methodless.

=> science, scientific (=scientifical), scientifically, scientism, scientist.

II. Текст

Запомните следующие слова и словосочетания

activation	to investigate	to heat
apporximate	error (=trial-and-error)	heat (n)
be concerned with	branch of science	to suggest
gasoline	harmful	discovery
observation	to decrease	to state
pollution	averaging	relationship
pure science	to vary	to describe
to arise (arose, arisen)	researcher	rigorous
to carry	to obey	fluid
absorption	comparison	to find out
to cause	to enable	pattern
to observe	beneficial result	Data(datum)
to search for	to achieve	to carry out
to solve a problem	to devise a plan	hypothesis (hypotheses)

SCIENCE AND SCIENTIFIC METHODS

-1-

Science. Scientists search for facts about the world around them. They try to find logical explanations for what they observe.

For some scientists, discovery and explanation are ends in themselves. The work of these scientists is called pure science. Pure science is the search for a better understanding of our physical and natural world for its own sake. Pure scientists are not concerned with finding uses for their discoveries. Pure scientists get satisfaction from simply knowing why things are as they are and why they happen as they do. Most of us have some of this type of curiosity. The study of science can give you the satisfaction that comes with understanding.

Science also has a practical side, called applied science. Applied science, or technology, is the practical application of scientific discoveries. Applied scientists put scientific discoveries to work. The technology produced by applied scientists has made possible the current state of our civilization. As a result of technology, many people today have easier lives and live longer.

But technology has been a mixed blessing. At the very time that it has solved some of our problems, it has created others. It has given us faster and more comfortable ways to travel but has led to the atmospheric pollution caused by the burning of gasoline. Most of the problems created by technology have arisen as side effects of otherwise beneficial technology. The goal of scientists is to achieve only beneficial results from their work. Therefore, much time, energy, and money is being spent to find ways to decrease or eliminate the harmful side effects without lowering the high standard of living that technology has made possible.

The Scientific Method. The way in which a scientist goes about solving a problem is called the scientific method. Although the scientific method varies in some details from one branch of science to another, certain steps are common to all science, including chemistry. These steps are:

Stating a problem. In any scientific investigation, it is necessary to know just what you are trying to find out. Often, the problem can be stated in the form of a question.

Collecting observations. Someone investigating a scientific problem begins by setting up experiments. Experiments are carefully devised plans and procedures that enable researchers to make observations and gather facts that shed light on a problem.

Searching for scientific laws. Many scientists carry out experiments. They collect much data. By studying these data, scientists are able to state a scientific law. A scientific law states a relationship between observed facts. It often takes a mathematical form. Scientific laws describe natural events but do not explain them.

Forming hypotheses. A scientist tries to find out why things obey an observed law. Often, the scientist will make an educated guess (a tentative explanation) about the reasons for the law. For example, the scientist may suggest that heat is an invisible fluid. When a gas is heated, the heat fluid enters the gas, thus causing it to take up more space. Such an educated guess, based on observed facts, is called a hypothesis.

Forming theories. Scientific observations and laws are like the pieces in a jigsaw puzzle. When enough pieces have fallen into place, a meaningful pattern emerges. This pattern is a theory. A theory provides a general explanation for the observations made by many scientists working in different areas of research over a long period of time.

A theory shows a relationship between observations that at first seemed totally unrelated. A theory, therefore, unifies many pieces of information to produce a grand design.

Modifying theories. A theory can never be established beyond all about. There is always the chance that someone will make a new observation or discover a new law that the theory should be able to explain but cannot. When this happens, it might be possible to modify the theory to fit the new facts.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. What do scientists try to find?

2. What is pure science?

3. Are pure scientists concerned with finding uses for their discoveries?

4. Applied science is the practical application of scientific discoveries, isn't it?

5. Applied scientists put scientific discoveries to work, don't they?

6. Has the technology produced by applied scientists made possible the current state of our civilization?

7. Why do many people today have easier lives and live longer?

8. Has technology been a mixed blessing and why?

9. What is the goal of scientists?

10. What kind of steps are common to all science, including chemistry?

11. Can the problem be stated in the form of a question?

12. Someone investigating a scientific problem begins by setting up experiments, doesn't he?

13. What is a scientific law?

14. Does a scientific law often take a mathematical form?

15. Scientific laws describe natural events, don't they?

16. Do scientific laws explain natural events?

17. What does a scientist try to find out?

18. What does a theory show?

19. Why does a theory unify many pieces of information?

20. Is there a chance that someone will make a new observation or discover a new law that the theory should be able to explain but cannot?

2. Обратите внимание на сочетаемость слова *method* с другими словами для образования различных терминов и дайте русские эквиваленты этих терминов*:*

absorption
activation
approximate
averaging — method
comparison
error (=trial-and-error)
rigorous

3. Расшифруйте следующие сокращения и переведите их на русский язык. Проверьте себя по ключу (Приложение 6).

сокращение	развёрнутая форма	перевод
sci.		
hyp. (=hypoth.)		

4. Вспомните, с какими определениями употреблены следующие существительные. Проверьте себя по тексту.

~ explanation
~ understanding
~ application
~ results
~ events

IV. Дополнительные тексты для просмотрового чтения с последующим переводом с листа

CONTROLLED EXPERIMENTS

When scientists do an experiment, they set up a situation in which they can control certain factors, or variables. A variable is something whose value can be made to change. For example, when you are driving a car, your speed is a variable. You can go faster or slower by depressing the accelerator or letting up on it. During a controlled experiment, scientists change the variables one at a time, and after each variable is changed, note what effect that particular variable is having on the results of the experiment. The results of an experiment, which often include a collection of measurements, are called observations, or data.

Sample problem. You turn on the switch to an electric lamp, but the light does not go on. Conduct a controlled experiment to determine why.

Solution. As a start to solving this problem, you should form a mental list of what factors might be causing it. Some possible causes are:

- the light bulb is burned out,
- the switch is worn out,
- the electric circuit that supplies electricity to the lamp is not working. Perhaps the circuit was overloaded, and the fuse blew out or the circuit breaker tripped,
- one of the wires in the lamp cord broke. This could happen either in the plug, in the lamp, or somewhere between them. In effect, the possible causes are hypotheses, they being educated guesses concerning why the lamp does not work.

Now for the experiment itself. For it to be a controlled experiment, you should test one possible cause at a time. To make it easier, you should first test the possible cause that is easiest to test. Proceeding on this basis, you can turn on another lamp to see whether the bulb in that lamp works. If it does, you then can replace the bulb in the lamp that is not working with the good bulb. If the light still does not go on, you can test the other possible causes.

Practice problem. As the head chef of a company that sells baked goods, you baked a cake according to the recipe, but you did not like the texture of the cake. You decided to try again, and as a second attempt, you used less flour and one more egg than the recipe called for, which produced a better cake. Explain why your second attempt was or was not a controlled experiment. If you were to make a third attempt, how would you proceed?

FALSE THEORIES

Only in the 17th century chemists began to base their conclusions on precise experiments. Robert Boyle (1627 – 1691) was the first to apply a new method of investigation based on the generalization of experimental data and the laws of nature. Robert Boyle thought that the task of the chemist is to perform experiments, accumulate observations, and not to put forth a theory without a thorough investigation. Boyle's theoretical works, and especially his method of investigation influenced the progress of chemistry. However, it took chemistry another 100 years to free itself from the wrong conception of matter. This period is marked by the reign in chemistry so-called phlogiston theory founded towards the end of the 17th century by the German chemist Stahl.

The phlogiston theory owed its origin to the need to explain the combustion, oxidation and reduction of metals. Chemists were greatly interested in these processes in connection with the progress of metallurgy during the 17th century. According to Stahl's theory, all combustible substances, including metals, contained a common inflammable principle or materia ignea, which he called phlogiston. When combustible substances were burned, or metals calcined, the phlogiston volatilized, leaving an earthy residue – calx. Hence, combustion was the decomposition of a substance into phlogiston and an earthy residue. For example: zinc = phlogiston + zinc calx.

Substances such as coal, which left a very small earthy residue upon combustion, were considered to be almost pure phlogiston.

The phlogiston theory was universally recognized for a long time. However, like any other false theory, it retarded the progress of chemistry.

Chemistry was freed from the phlogiston theory in the latter half of the 18th century as a result of the precise methods of investigation introduced by the Russian scientist Mikhail Lomonosov (1711 – 1765). Lomonosov laid the foundation to the development of the chemical science and to the modern atomic theory.

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

FORMING AND MODIFYING THEORIES

-1-

A scientist tries to find out why things obey an observed law. Often, the scientist will make an educated guess (a tentative explanation) about the reasons for the law. For example, the scientist may suggest that heat is an invisible fluid. When a gas is heated, the heat fluid enters the gas, thus causing it to take up more space. Such an educated guess, based on observed facts, is called a hypothesis. It may seem to be a good explanation of the facts, but it must be tested by new and different experiments. The above heat hypothesis was accepted by scientists for a long time. But it had to be given up because it did not agree with later experiments.

Scientific observations and laws are like the pieces in a jigsaw puzzle. When enough pieces have fallen into place, a meaningful pattern emerges. This pattern is a theory. A theory provides a general explanation for the observations made by many scientists working in different areas of research over a long period of time. A theory shows a relationship between observations that at first seemed totally unrelated. A theory, therefore, unifies many pieces of information to produce a grand design.

One of the most useful theories of science is called the kinetic theory of gases, it being highly successful in explaining and predicting the behaviour of all kinds of gases under all sorts of conditions.

-2-

A theory can never be established beyond all doubt. There is always the chance that someone will make a new observation or discover a new law that the theory should be able to explain but cannot. When this happens, it might be possible to modify the theory to fit the new facts. For example, the molecular theory of gases, in its original form, did not accurately predict the behavior of gases under great pressure or at very low temperatures. Only after a while it was possible to modify the theory to make it agree with these new observations.

A thoroughly tested theory seldom has to be thrown out completely. But sometimes a theory may be widely accepted for a time and later disproved, the phlogiston theory of burning being an example. According to the theory, when burnt materials give off phlogiston. Burning stops, when the air is filled with phlogiston. The phlogiston theory seemed to explain why a candle would burn for only a short period of time in a closed container. The theory was even used to explain why substances burn even more vigorously in oxygen than in ordinary air. Oxygen was supposed to be a kind of air containing less phlogiston compared to ordinary air. But in 1778, French chemist Antoine Lavoisier demonstrated that a burning substance, rather than giving off something to the air, actually removed something from it – oxygen. Lavoisier's work became the basis of our modern theory of burning, the phlogiston theory being gradually discarded.

THE RESEARCH PAPER

1

The general aim of research is to answer questions by giving fair consideration to the best available evidence. Research can be conducted in a laboratory, by a field investigation, or in many other ways; but the research for a freshman paper is usually confined to printed material, either collected in a source-book or waiting to be discovered in the college library. The job may be broken down into the following five steps: (1) finding a good question; (2) locating the best printed evidence in this question; (3) considering this evidence until you reach a reasonable conclusion; (4) organizing your findings; (5) presenting these findings in such a way that one can easily check their accuracy and completeness.

A good many students concentrate too much and too early on the fifth step. The mechanics of a term paper – physical organization, footnotes, bibliography, and so forth – are certainly important, and will be explained in this chapter at some length. But these things are only means to an end. If you understand how and why they work you should be able to get them straight and use them reasonably and accurately. If you do not you may well blunder along, trying to get two footnotes on a page (whether it needs ten or none), oppressed of a sense of futility and feeling extremely vague about what you are trying to do.

-2-

Some of the material that you need has probably been published in periodicals rather than in book form. Such material may be located through various periodical indexes.

The Reader's Guide to Periodical Literature, for instance, is the index that freshmen are most likely to find useful (and also the one that nearly all college libraries have). It covers popular magazines that contain the least serious information or at least some serious one – roughly, the range from *Look to Scientific American.* If your subject is of contemporary interest, be sure that you examine the latest issues available.

The entries in the indexes are highly condensed to save space, and may not always be clear at the first glance. The best way to master them is to examine the explanations at the front of the volume, then check out a couple of magazines covered by the index you are using. Every item in an entry means something. Examine the magazine until you are sure just what it does mean and you should have no further trouble. If there is anything you cannot make out after a fair try, ask your instructor to help you; but do not expect him to explain it all before you start.

In addition to the mentioned above, there are several other indexes which you may find to be helpful. They vary considerably in both the quality of the editing and the periods covered; and your library may not have them all. But since any one of them may save your hours of looking for needles in haystacks, it is worth while looking for any that seem appropriate.

THE CHEMICAL INFORMATION SYSTEM

-1-

We live in the information age. In the past few decades, there has been an ‘information explosion’ in most fields. Scientific knowledge, especially, has been increasing very rapidly. When a chemist, for example, develops a new substance, it takes time to get it into scientific reference books. The books are not updated and reprinted fast enough to keep up with current developments. To answer a chemistry-related question, it can take weeks to search through these books. And even then, the answer may be out of date.

To deal with these information problems, chemists use computers. Computers can give chemists access to chemical data banks, can answer chemistry questions in minutes rather than weeks. The Chemical Information System (CIS) is the largest of these data banks. It consists of more than thirty data bases, each dealing with a particular aspect of chemistry. The CIS is used by government agencies, colleges and universities, private industry, hospitals, poison-control centers, and emergency-response teams.

-2-

The CIS has information on more than 350 000 chemicals. Someone using the system can find out a chemical’s structure, molecular formula, chemical name, and other names by which the chemical is known in commerce and manufacturing. A user also can use the system to do ‘searches’. For example, the system can be searched for all compounds containing a specific structural fragment as well as on the basis of name, molecular formula, molecular mass, and atom count. And when given some of this information about an unknown chemical, the system can come up with a list of what the chemical might be.

Searches of these kinds would take weeks of monotonous research without such a computer system.

The CIS includes many more-specialized data bases, as well. The Mass Spectral Search System can search for a chemical's mass spectrum. It also can list chemicals with similar mass spectra. The Oil and Hazardous Materials/Technical Assistance Data System provides information to emergency-response-team personnel. This information can include methods of disposing of a hazardous material and recommended limits of certain chemicals in drinking water. The Physicians Desk Reference data base contains essential information on major drugs. This information includes descriptions of drugs, dosages, and side effects. Data bases are essential in this information age and save chemists and other professionals much valuable time.

THE DIFFERENCE BETWEEN SCIENTIFIC LAW AND THEORIES

A scientific law is a statement of the regularity, a uniformity of the behaviour of matter and energy. A theory is the most acceptable explanation of facts which are known or observed. Theories are tentative explanations and are changed or discarded as new facts or knowledge become available.

What is meant by the scientific method?

The scientific method is a general way of thinking used by scientists in solving problems. This process includes: clearly defining the problem, collecting all of the evidence that is available, setting up a possible answer (hypothesis), conducting an experiment to see if the hypothesis is correct, arriving at a conclusion based on the information gathered in the experiment, and testing the conclusion.

Урок 3
Discoveries of the Past

I. Предтекстовые упражнения

1. Вспомните, какими временными формами можно передать *прошедшее время* при переводе с русского языка на английский язык. (Приложение 1, §§ 1, 4)

2. На примере предложений из текста определите, какие четыре формы прошедшего времени из пяти существующих в английском языке использованы в тексте урока и проанализируйте их употребление:

=> The earlier divisions of chemistry *have* practically *disappeared.*

=> Two facts *helped* the development of inorganic chemistry.

=> Thus we find that by this time organic chemistry and physical chemistry *were* constantly *attracting* workers of inorganic chemistry.

=> When the mold *had cooled*, the material in it retained the precise shape of the mold even to the tiniest detail.

3. Раскройте скобки, поставив глагол в Past Simple, Past Continuous, Past Perfect или Past Perfect Continuous:

=> This week they (to write) their scientific report.

=> Last week they (to write) their scientific report.

=> They (to write) their scientific report by the end of the week.

=> They (to write) their scientific report for 2 hours when I came.

=> They (to write) their scientific report when I came.

4. В предложении отсутствуют знаки препинания. Расставьте их и проверьте себя по тексту:

We may start with 1828 the year in which Wöhler the pioneer of organic synthesis showed the interrelationship between inorganic and organic chemistry.

5. Определите правильное место в предложении для находящегося в скобках слова:

Many will say that this is not the definition of inorganic chemistry, but chemistry itself. *(alone)*

6. Выберите правильное слово:

The *plastique/plastics/plaster/plastery* industry started because ivory was scarce.

7. *Вставьте пропущенное слово:*

The year 1887 may be accepted as the … of appearance of physical chemistry.

8. Какое из следующих составных прилагательных можно использовать как определение к существительному *plastic:*

self-made
man-made — plastic
ready-made

9. Замените выделенное слово на его синоним. Проверьте себя по тексту.

Let's make a *brief* survey of the history of the subject.

10. Найдите в словаре перевод следующих однокоренных слов:

=> plastic, plastics, plasticated, plastically, plasticize.

II. Текст

Запомните следующие слова и словосочетания

because of	owing to	to retain
carbon	to progress	mixture
compound	synthesis	to attract
definition	to deal with (dealt, dealt)	substitute for
division	to affect	to accept
measurement	determination	to treat
prospect	appearance	mold
reaction	survey	constantly
technique	to determine	precise
thus	research worker	to cool
to define	achievement	precision
to disappear	analysis (analyses)	man-made

DISCOVERIES OF THE PAST

PROGRESS OF INORGANIC CHEMISTRY

We shall define inorganic chemistry today as the study of formation, composition, structure, and reactions of the chemical elements and their compounds, except those of carbon. Many will say that this is not the definition of inorganic chemistry alone, but chemistry itself.

Indeed, the earlier divisions of chemistry have practically disappeared and the subject is becoming an intergrated whole.

Two facts helped the development of inorganic chemistry: the growth of the theoretical techniques of quantum mechanics and new optical, electrical and magnetic techniques of physical measurement by which structure can be investigated. For a full understanding of the way in which these achievements affected the development of inorganic chemistry, let's make a short survey of the history of the subject.

We may start with 1828, the year in which Wöhler the pioneer of organic synthesis, showed the interrelationship between inorganic and organic chemistry. For the next fifty years inorganic and organic chemistry progressed side by side. The main work in inorganic chemistry dealt with the preparation of new compounds and the development of methods of analysis. Great numbers of new compounds were being described and important work was being carried out on the determination of atomic weights. The year 1887 may be accepted as the date of appearance of physical chemistry as another branch of the subject. Many research workers were now interested in physical chemistry because it offered the precision which was lacking in inorganic chemistry. At the same time, organic chemistry developed into a system in which structure could be determined. Without the technique for such stereochemical investigations inorganic chemistry lagged behind. Thus we find that by this time organic chemistry, because of its system, and physical chemistry, because of its precision, were constantly attracting workers of inorganic chemistry. People say that facts give a science its substance, but it is the theory which provides its strengths. It is owing to the development of the theory that inorganic chemistry has before it such exciting prospects at the same time.

THE ORIGIN OF PLASTIC

The plastics industry started because ivory was scarce and ivory billiard balls were very expensive. That was the reason the firm of Phelan & Collander in New York soon after the Civil War offered a prize of $ 10,000 for a substitute for ivory that could be used to make billiard balls. Many inventors were attracted by this prize. One of them was John Wesley Hyatt, who succeeded not in making a billiard ball, but in producing the first satisfactory man-made plastic. He did this by mixing camphor with cotton which had been treated with nitric acid and pressing the mixture in a hot mold. When the mold had cooled, the material in it retained the precise shape of the mold even to the tiniest detail. That was the beginning of celluloid.

UPDATE

John Wesley Hyatt did not invent celluloid, he acquired the patent from British inventor who couldn't find an application for his discovery. After winning the $ 10,000 prize in 1872, Hyatt used it to make billiard balls in Newark, New Jersey.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. How can inorganic chemistry be defined?

2. What kind of facts helped the development of inorganic chemistry?

3. Who was the pioneer of organic synthesis?

4. The main work in inorganic chemistry dealt with the preparation of new compounds and the development of methods of analysis, didn't it?

5. What happened in 1887?

6. Why were many research workers interested in physical chemistry?

7. Did organic chemistry develop into a system in which structure could be determined?

8. By this time organic chemistry and physical chemistry were constantly attracting workers of inorganic chemistry, weren't they?

9. Why did the plastics industry start?

10. Who succeeded in making a billiard ball and in producing the first satisfactory man-made plastic?

11. Did John Wesley Hyatt invent celluloid?

12. Where did Hyatt make billiard balls?

2. Обратите внимание на сочетаемость слова *technique* с другими словами для образования различных терминов и дайте русские эквиваленты этих терминов:

$$\left.\begin{array}{c}\text{computing}\\ \text{experimental (=testing)}\\ \text{improved}\\ \text{measuring}\end{array}\right\}\quad \text{technique}$$

3. Расшифруйте следующие сокращения и переведите их на русский язык. Проверьте себя по ключу (Приложение 6).

сокращение	развёрнутая форма	перевод
elect.		
mag. (=magn.)		
opt.		

4. Вспомните, какой предлог употреблен в следующих предложениях. Проверьте себя по тексту.

=> One of them was John Wesley Hyatt, who succeeded … producing the first satisfactory man-made plastic.

=> Many research workers were now interested … physical chemistry.

IV. Дополнительные тексты для просмотрового чтения с последующим переводом с листа

THE HISTORY OF CHEMISTRY SCIENCE

Many years ago people already knew how to obtain many useful materials. They could smelt metals from their ores, produce and utilize various alloys, as well as manufacture glass and glassware. Long before our era the Egyptians smelted iron from its ores, produced stained glass, and extracted medicines, dyes, and perfumes from plants. Chemical production in India and China dates from still earlier times.

More than two thousand five hundred years ago man first arrived at the thought that the universe is composed of atoms. This idea was most perfectly expressed by Democritus, the great Greek philosopher. According to Democritus, all bodies in nature are built up of minute, indivisible particles – atoms. Atoms are so small that they cannot be seen. They may be different in shape and size. The differences between substances depend on differences in the number, shape and arrangement of the atoms they consist of. Atoms are in eternal motion.

The materialistic teachings of Democritus were far in advance of the views of his contemporaries, but did not receive general recognition.

According to the opinion prevailing today, chemistry as a science arose at the beginning of our era in Alexandria, a city on the Nile. Alexandria was an immense commercial and cultural centre. It concentrated the practical knowledge of Egypt and developed the philosophical ideas of ancient Greece. Treatises written in Alexandria in the first century of our era contained a great deal of chemical information, many illustrations showing chemical apparatus, and descriptions of calcining, volatilizing, filtering, dissolving, and crystallizing. Here also arose the idea of transmuting base metals into gold. This idea diverted chemistry for a long time from the path of fruitful searchings, thus retarding its progress.

After the Arabian conquest of Egypt and other Eastern countries in the 7th century, part of the knowledge accumulated in Alexandria still remained intact. The Arabs made use of this knowledge and subsequently discovered and investigated many substances, including nitric acid, and various salts. The word ‘chema’ which had been used by Alexandrian scientists got the Arabian prefix ‘al’ and became ‘alchemy’. The Arabian scientists left a number of books containing descriptions of different chemical experiments and practical information. The conquest of Southern Spain by the Arabs promoted the penetration of practical knowledge into Western Europe. With the Arabs came the idea of transmuting base metals into gold.

In the history of chemistry the Middle Ages are known as the period of alchemy. Contrary to Arabian alchemy, which had played a positive part in the development of science, West-European alchemy was an antiscientific, reactionary trend. It was under the control of the catholic church. All the efforts of the alchemists were directed towards the search of the mysterious 'philosopher's stone' which might restore youth, prolong life and change base metals into gold.

Alchemy was never widespread in Russia. Until the 17^{th} century Russian practical chemistry developed independently of Western Europe. Chemical information in Russia was exchanged mainly with the Near East (Byzantium, Armenia, etc.).

During the Renaissance chemistry really began to progress, and chemists started to solve practical problems. A new trend of chemistry known as iatro-chemistry (medical chemistry) developed. It was founded by Paracelsus, a Swiss physician who thought that the main object of chemistry is the preparation of medicines. Many physicians engaged in chemical research. The new trend forced back the 'problems' of alchemists and placed the study of chemical change on a sound footing.

About that time the works of Agricola laid the foundation of metallurgy and opened up a new sphere of the application of chemistry.

METRIC SYSTEM AND ITS ORIGIN

The idea of a universal system of measures and weights dates from long ago, but it was realized only two centuries ago. The metric or decimal system was worked out by the French Academy of Sciences in 1791.

How were the units for length and weight defined?

Two French scientists who were given the task to define these units took one fourth of the distance from the North Pole to the Equator on the geographical meridian which is running through Paris (the distance from Dunkirk in France to Barcelone in Spain) and divided it into ten million equal parts. One of these parts was called a metre or "measure". For shorter measurements the metre was divided by ten, for longer things the metre was multiplied by tens.

It was easy to use the same metre for volume. The weight of one cubic centimeter of water was called a gramme. Thus the metric system was created.

Russian scientists played a great part in the spreading of the metric system in Russia as well as in other countries.

As far as in 1867 D. I. Mendeleyev addressed Russian scientists to help to spread the decimal system. The project of the law about the use of the metric system in Russia was also worked out by D. I. Mendeleyev.

It should be said, however, that up till the end of the 19th century different units of measurement were used in various countries. In the Soviet Union the metric system was adopted in 1918, soon after the Great October Socialist Revolution. Now it is adopted by most of the countries. None of the systems of the past can be compared in simplicity to that of our days.

WINE COOLER

From Japan came the aluminium can that chilled itself. Gekkeikan Co. of Kyoto began selling sake in a can with a special lower compartment filled with ammonium nitrate and a plastic container of water. When one pushed the bottom of the can, the plastic container burst and the water mixed with the ammonium nitrate causing a chemical reaction that could lower the temperature of the sake by 15 $^{\circ}$C within three minutes.

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

BASIC LAWS OF CHEMISTRY

Three laws of chemistry were put forward in late eighteenth and early nineteenth centuries. Two pre-date Dalton`s atomic theory and the third (the law of multiple proportions) was developed from it. These laws were of great importance in the development of the atomic theory.

Law of constant composition

States that all pure samples of the same chemical compound contain the same elements combined in the same proportions by mass. It was developed by a Frenchman, Joseph Proust, in 1799.

Law of conservation of mass

States that matter can neither be created nor destroyed during a chemical reaction. It was developed by a Frenchman, Antoine Lavoisier, in 1774.

Law of multiple proportions

States that if two elements, A and B, can combine to form more than one compound, then the different masses of A which combine with a fixed mass of B in each compound are in a simple ratio. It is an extension of Dalton`s atomic theory.

THE HISTORY OF POLYMERS

Today the market is flooded with different materials. Modern life would be incomparably different without synthetic chemicals which are called as polymers.

Man-made fibres are used in clothing, carpets and curtains while plastics are used in innumerable domestic and industrial applications and artificial joints, and paints and cleaning materials, are all different forms of this important discovery. What is often forgotten is that at the beginning of the 20th century the chemistry of large molecules was unknown and their synthesis was definitely unthinkable.

Large Molecules. When a German scientist named Hermann Staudinger proposed in the 1920s that it was possible to have large molecules which were made up of many thousands of atoms, he was ridiculed by many other scientists. The common wisdom was that the structures of such materials as rubber and Bakelite were actually many small molecules which were held together by an unknown force.

Organic Synthesis. Hermann Staudinger stuck to his guns and, with his colleagues, he synthesised a series of organic molecules which were called poly (methanals). These compounds were long chains of repeating units, the units being -$CH_2$0-. They are made by joining lots of methanal molecules together. The German scientists made chains of different lengths and showed that their properties changed depending on the length of the chains that were prepared.

Following this, the chemists working for Imperial Chemical Industries (ICI), soon discovered a polymer that reacted to organic molecules, ethylene which is now known as ethene and benzaldehyde, at very high temperature and pressure. The reaction failed to impress, but there was a small amount of a white, waxy substance on the wall of the reaction vessel. This was poly (ethene) or polythene, and soon ICI realised that they had a potentially useful compound.

The new material had many properties which made it unique. It was easy to form into different items and was tough and hard wearing and was impermeable to water and insulating to electricity. It was discovered in the 1930s and was soon being used in the Second World War to insulate the many metres of cables that were needed for the vital radar equipment that was used by the British.

THE FIRST PLASTICS

The first plastic was a result of mixing phenol and formaldehyde together. This resulted in a gooey substance called bakelite, the predecessor of plastic. The first plastic dates back to 1910, when Dr. Leo H. Baekeland produced 25 barrels of 'phenolic' plastic. Plastics are polymers that have a high molecular mass. The word plastic comes from Greek and means to fit or to mould.

Today the world produces more than 500 million pounds of plastics every year.

The reason why plastic is so popular is because the raw materials that are required to make this product are easily available. The basic plastic requires water, air, and coal. Other forms of plastic may also require petroleum or natural gas, salt and limestone.

Though plastic is a very popular material to use for making cost effective products, it does have its negative effects on the environment. Plastic is insoluble in water, it is chemically inert and has toxic additives. Plastics degrade very slowly making it problematic to dispose of.

Урок 4
Science of Tomorrow

I. Предтекстовые упражнения

1. Вспомните, что представляет собой согласование времен в английском языке. (Приложение 1, § 5)

2. Проанализируйте предложение из текста с точки зрения согласования времен (Приложение 1, § 6) и переведите это предложение на русский язык:

It was conceivable that the invention of fire by Stone Age would lead to disaster for our species.

3. Вспомните, как может быть выражено условие в английском языке. (Приложение 1, § 7)

=> If they continue to watch, what will these hypothetical aliens witness in the next 100 years?

=> What would have happened if we had somehow waved a magic wand and prevented the invention of agriculture?

5. Определите правильное место в предложении для находящегося в скобках слова:

They had devastated the fauna of Australia, the Americas and many islands. *(already)*

6. Выберите правильное слово:

Ree's *broom/toom/gloom* stands in a long tradition of dyspeptic futurology.

7. Вставьте пропущенное слово:

Steam engines, nuclear war, chemicals and genetically … food have come and gone without leaving us worse off.

8. Образуйте формы сравнительной степени от следующих прилагательных и используйте эти формы при переводе:

healthy, wealthy, wise, bad.

9. В предложении отсутствуют знаки препинания. Расставьте их и проверьте себя по тексту:

From Huxley's *Brave New World* and H.G. Wells to the modern environmental movement almost everybody has painted the future as a dismal place and almost everybody has so far been wrong.

10. Найдите в словаре перевод следующих однокоренных слов:

=> future, futurism, futurist, futuristic, futurity, futurology.

II. Текст

Запомните следующие слова и словосочетания

sustainable	to ignite	evidence
engine	innovation	to suggest
genetically modified food	previous	extinction
hypothetical	invention	agriculture
nuclear	lack in	efficient
radio waves	to invent	to prevent
species / (pl) species	conceivable	to result in
to emit	nitrogen	to consider
to survive	chemical	disaster
to witness	to turn smth into smth	on a vast scale

WILL THE HUMAN RACE SURVIVE THE TWENTY FIRST CENTURY?

Sir Martin Rees, the Astronomer Royal, is a worried man. He fears that our species cannot survive the present century, so great are the legions of things that might go wrong. He imagines extraterrestrial watching our solar system for aeons and witnessing a sudden spasm of activity as humanity begins to emit radio waves and sends vessels into space. “If they continue to watch, what will these hypothetical aliens witness in the next 100 years?”

Rees's gloom stands in a long tradition of dyspeptic futurology. From Huxley's *Brave New World* and H.G. Wells to the modern environmental movement, almost everybody has painted the future as a dismal place, and almost everybody has – so far – been wrong.

Steam engines, nuclear war, the population explosion, chemicals, social dislocation and genetically modified food have come and gone without leaving us worse off: in fact, the more technology we invent, the healthier, wealthier and wiser we become.

So why should Rees be right where so many past prophets have been wrong?

This is of course conceivable, that the chemical industry will tomorrow invent a kind of ice that turns all water into itself, or the nuclear industry will invent a bomb hot enough to ignite the atmosphere's nitrogen.

But all sorts of things are conceivable without being plausible or even possible. It was conceivable that invention of fire by Stone Age man would lead to disaster for our species.

There is undoubtedly a risk in innovation but there is also a risk in a lack of innovation, and stopping all invention at any point in our previous history would have resulted in humanitarian and ecological catastrophes on a vast scale.

Consider what would have happened, for instance, if we had somehow waved a magic wand and prevented the invention of agriculture. Evidence suggests that increasingly efficient hunter-gatherers would have continued their extinction of prey species – they had already devastated the fauna of Australia, the Americas and many islands – stopping only when the last tree in the last rain forest was felled.

The greatest risk of all is the risk of doing nothing.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. What does Sir Martin Rees fear?

2. Rees's gloom stands in a long tradition of dyspeptic futurology, doesn't it?

3. Has almost everybody painted the future as a dismal place?

4. What happens with the invention of technology?

5. Are there any suppositions concerning the development of the chemical industry?

6. All sorts of things are conceivable without being plausible or even possible, aren't they?

7. Was it conceivable that invention of fire by Stone Age man would lead to disaster for our species?

8. Is there a risk in innovation?

9. What would have happened if we had somehow waved a magic wand and prevented the invention of agriculture?

10. The greatest risk of all is the risk of doing nothing, isn't it?

2. Обратите внимание на сочетаемость слова *risk* с другими словами для образования различных терминов и дайте русские эквиваленты этих терминов:

$$\left.\begin{array}{r}\text{explosive}\\ \text{fire}\\ \text{nuclear}\\ \text{occupational}\end{array}\right\}\ \text{risk}$$

3. Какие философские и научные вопросы были рассмотрены в тексте? Сформулируйте эти вопросы как можно ближе к тексту.

4. Вспомните, с какими определениями употреблены следующие существительные. Проверьте себя по тексту.

~ futurology

~ catastrophes

~ scale

~ wand

~ forest

IV. Дополнительные тексты для просмотрового чтения с последующим переводом с листа

THE CHEMISTRY OF TOMORROW

Addressing global challenges means advancing fundamental scientific knowledge, supporting excellence in chemical science research and maximising the number of future breakthroughs. It will require an interdisciplinary approach to build bridges between chemisty's subdisciplines, and with other sciences and engineering.

Over 150 experts were brought together to discuss issues facing today's society, identifying seven prioriry areas. Within these seven areas, 41 challenges were defined and the role that chemistry will play in providing solutions was examined. In addition, the expertise, attitudes and opinions of the wider community were incorporated via web based consultation.

These seven priority areas have many areas of overlap, with strong links between associated challenges. The themes of sustainable development and climate change underpin the majority of the challenges.

The seven priority areas are summarised here:

- Energy. Creating and securing environmentally sustainable energy supplies, and improving efficiency of power generation, transmission and use.
- Food. Creating and securing a safe, environmentally friendly, diverse and affordable food supply.
- Future cities. Developing and adapting cities to meet the emerging needs of citizens.
- Human health. Improving and maintaining accessible health, including disease prevention.
- Lifestyle & recreation. Providing a sustainable route for people to live richer and more varied lives.
- Raw materials & feedstock. Creating and sustaining a supply of sustainable feedstock, by designing processes and products that preserve resources.
- Water & air. Ensuring the sustainable management of water and air quality, and addressing societal impact on water resources (quality and availability).

TOP-TEN CHALLENGES FOR THE CHEMICAL SCIENCES

To ensure progress is made where it matters most, we have identified 10 of the 41 challenges as priorities for the next 5-10 years, following consultation with the chemical science community.

Listed alphabetically, these are:

- agricultural productivity: significantly and sustainably increase agricultural productivity to provide food, feed, fibre and fuel;
- conservation of scarce natural resources: develop altrenative materials to conserve precious resources and new processes to extract valuable materials from untapped sources;
- conversion of biomass feedstocks: develop biorefineries using different types of biomass to provide energy, fuel and a range of chemicals with zero waste;
- diagnostics for human health: enable earlier diagnosis and develop improved methods to monitor diseases;
- drinking water quality: use new technologies to help provide clean, accessible drinking water for all;
- drugs & therapies: harness and enhance basic sciences to transform drug discovery, development and healthcare, delivering new therapies more efficiently and effectively;
- energy conversion and storage: improve the performance of energy conversion and storage technologies, such as batteries, and develop sustainable transport systems;
- nuclear energy: ensure the safe and efficient harnessing of nuclear energy, through the development of fission and investigation into fusion technologies;
- solar energy: develop existing technologies into more cost efficient processes and develop the next generation of solar cells to realise the potential of solar energy;
- sustainable product design: take into account the entire life cycle of a product during initial design decisions to preserve valuable resources.

MAKE IT HAPPEN

Chemistry has great capacity to solve many of the global challenges that society is facing. These challenges can only be addressed if we provide for an excellent, diverse and well-maintained science base, a good supply of well-trained individuals, and an innovative climate from which good ideas can flourish, be exploited and be communicated around the world. There are also exciting opportunities to develop new projects that will enable us to tackle each of the key challenges.

No country can afford a skills shortage, which could leave the next generation ill-equipped to tackle major scientific and technological challenges. A diverse and technically innovative workforce is fundamental to developing and applying new technologies.

To maintain the flow of future breakthroughs, it is critical to advance fundamental knowledge and to support curiosity driven research.

There also needs to be a sustainable commitment to innovation from the leaders of key organisations to establish a culture where investment in research and innovation can thrive.

Let us ensure that future generations enjoy a life of quality and beauty by the intelligent application of chemical knowledge.

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

SUPERCONDUCTORS

Imagine you're an electron on a motorcycle, zooming along on a smooth, empty road. No speed breakers or potholes to stop you. In an instant, you've reached your destination. Well, for an electron, such a road is called a superconductor.

How superconductivity works

When electrons move through a metal wire, we get electricity. But the path is not smooth. The metal resists the flow of electrons, as the metal atoms may absorb a few electrons instead of letting them through. This lowers the current that passes through the wire.

If you lower the temperature of the wire, it allows more current to pass through. When you reach a really low temperature, the resistance of the metal suddenly drops to zero. This is called the critical temperature (Tc), and it is different for different metals. This phenomenon is called superconductivity.

High Temperature Superconductors

For most metals, the Tc is very close to absolute zero (-273.15°C). For example, mercury has a Tc of - 277.35°C. But there are some materials which become superconductors at much warmer temperatures. These are called high-temperatures superconductors (HTSs). But don't be fooled by the name, these materials still need to be cooled below -138°C to work as superconductors. Luckily you can do that with liquid nitrogen, which has a temperature of about -196°C.

So what kind of materials are these? They are not pure metals, but mixtures of metal oxides. One such is 'Bisco', or Bismuth-strontium-calcium-copper-oxide (Tc -165.15°C). Another is 'Yibco' (Yttrium-barium-copper oxide, Tc -183.15°C), and yet another is 'Tibco' (Thalium-barium-calcium-copper oxide, Tc - 146.15°C). In fact, many superconductors have one or the other rare earth metal, which you can see in the periodic table as the Lanthanide series. But materials like Yibco, Tibco and Bisco are quite difficult to make, and quite expensive too.

FUTURE FUEL: FROM YOUR SEPTIC TANK

Today, almost all the petrol and diesel we use come from petroleum. But petroleum sources are harder and harder to find. By making sewage into oil, we can avoid both problems.

Sewage is rich in organic matter like proteins, fats and carbohydrates (think unused or spoiled food, vegetable peels and other waste). When it is treated at municipal plants, the sewage is separated into water and sludge. The water is purified and released into nature. The sludge is detoxified and placed in landfills.

Instead, the sludge can be used for making fuel. This is just like how gobar gas is made in India. Special kinds of bacteria eat up the sludge, and release methane gas. The gas can be collected and compressed into cylinders, like the ones we use for cooking gas. Some kinds of algae produce oil instead of gas. This oil can be distilled and used as a fuel for cars, pumps, and trucks.

Right now, this fuel is not cheap. But scientists are breeding different kind of algae that will make even more oil. Right now 30% of the sludge is converted to oil.

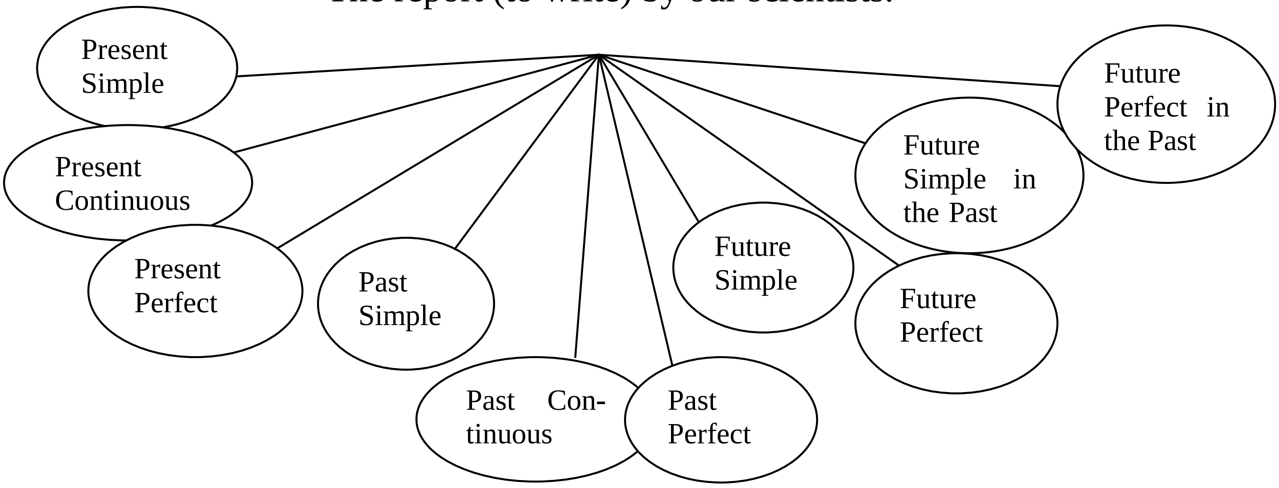
Урок 5
Technology Today

I. Предтекстовые упражнения

1. Вспомните, что такое страдательный залог и чем он отличается от действительного залога. (Приложение 1, §8)

2. Пользуясь общей формулой (Приложение 1, §7), раскройте скобки и поставьте глагол во всех временах страдательного залога.

The report (to write) by our scientists.



ответы:
present simple - is written
present continuous - is being written
present perfect - has been written
past simple - was written
past continuous - was being written
past perfect - had been written
future simple - will be written
future perfect - will have been written
future in the past - would be written
future perfect in past - would hsve been written

3. На примере предложений из текста определите время глагола - сказуемого в страдательном залоге:

=> Not all technology *has been used* for peaceful purposes.

=> The development of technology *was restricted* only to human beings.

=> Both terms *are* usually *translated* as technology.

4. Замените в следующих предложениях из текста страдательный залог на действительный залог:

=> The exact relations between science and technology *have been debated* by scientists, historians, and policymakers since the late 20^{th} century.

=> The term *was* often c*onnected* to technical education.

=> The three fields *are* often *considered* as one for the purposes of research and reference.

5. Определите правильное место в предложении для находящегося в скобках слова:

Technologies are not usually products of science. *(exclusively)*

6. Выберите правильное слово:

The word technology can also be used to refer to a *collation/collusion/collection/collision* of techniques.

7. Вставьте пропущенное слово:

Technology rose to prominence in the 20^{th} century in connection with the Second … Revolution.

8. Измените следующие слова, уменьшив количество букв в слове на одну и найдите эти слова в тексте:

stool, ass, mother, drawl, scan, humane.

9. В предложении отсутствуют знаки препинания. Расставьте их и проверьте себя по тексту:

In this context it is the current state of humanity's knowledge of how to combine resources to produce desired products to solve problems fulfill needs or satisfy wants.

10. Найдите в словаре перевод следующих однокоренных слов:

=> technologic(al), technologist, technologize, technology.

II. Текст

Запомните следующие слова и словосочетания

ability	to allow	raw material
consequence	advanced technology	semiconductor
however	to be aimed at	although
in order to	available	to fulfill
machine	natural	term
modification	to harm the environment	conductor
procedure	to increase	entity
to improve	including	requirement
field of knowledge	purpose	to satisfy requirements
to perform a function	to improve	phenomenon (phenomena)
to refer to	condition	to employ a technique
tool	to affect	human
usage	significantly	to restrict

TECHNOLOGY

-1-

Technology is the making, modification, usage, and knowledge of tools, machines, techniques, crafts, systems, methods of organization, in order to solve a problem, improve a preexisting solution to a problem, achieve a goal, handle an applied input/output relation or perform a specific function. It can also refer to the collection of such tools, machinery, modifications, arrangements and procedures. Technologies significantly affect human as well as other animal species' ability to control and adapt to their natural environments.

The human species' use of technology began with the conversion of natural resources into simple tools. The prehistorical discovery of the ability to control fire increased the available sources of food and the invention of the wheel helped humans in travelling in and controlling their environment. Recent technological developments, including the printing press, the telephone, and the Internet, have lessened physical barriers to communication and allowed humans to interact freely on a global scale. However, not all technology has been used for peaceful purposes; the development of weapons of ever-increasing destructive power has progressed throughout history, from clubs to nuclear weapons.

Philosophical debates have arisen over the present and future use of technology in society, with disagreements over whether technology improves the human condition or worsens it. Neo-Luddism, anarcho-primitivism, and similar movements criticize the pervasiveness of technology in the modern world, opining that it harms the environment and alienates people; proponents of ideologies such as transhumanism and techno-progressivism view continued technological progress as beneficial to society and the human condition. Indeed, until recently, it was believed that the development of technology was restricted only to human beings, but recent scientific studies indicate that other primates and certain dolphin communities have developed simple tools and learned to pass their knowledge to other generations.

The use of term *technology* has changed significantly over the last 200 years. Before the 20th century, the term was uncommon in English, and usually referred to the description or study of the useful arts. The term was often connected to technical education.

"Technology" rose to prominence in the 20th century in connection with the Second Industrial Revolution. The meanings of technology changed in the early 20th century when American social scientists, beginning with Thorstein Veblen, translated ideas from German concept of Technik into "technology". In German and other European languages, a distinction exists between *Technik* and *Technologie* that is absent in English, as both terms are usually translated as "technology".

-2-

Today, technology can be most broadly defined as the entities, both material and immaterial, created by the application of mental and physical effort in order to achieve some value. In this usage, technology refers to tools and machines that may be used to solve real-world problems.

The word "technology" can also be used to refer to a collection of techniques. In this context, it is the current state of humanity's knowledge of how to combine resources to produce desired products, to solve problems, fulfill needs, or satisfy wants; it includes technical methods, skills, processes, techniques, tools and raw materials.

The distinction between science, engineering and technology is not always clear. Science is the reasoned investigation or study of phenomena, aimed at discovering enduring principles among elements of the phenomenal world by employing formal techniques such as the scientific method. Technologies are not usually exclusively products of science, because they have to satisfy requirements such as utility, usability and safety.

Engineering is the goal-oriented process of designing and making tools and systems to exploit natural phenomena for practical human means, often (but not always) using results and techniques from science. The development of technology may draw upon many fields of knowledge, including scientific, engineering, mathematical, linguistic, and historical knowledge, to achieve some practical result.

Technology is often a consequence of science and engineering – although technology as a human activity precedes the two fields. For example, science might study the flow of electrons in electrical conductors, by using already-existing tools and knowledge. This new-found knowledge may then be used by engineers to create new tools and machines, such as semiconductors, computers, and other forms of advanced technology. In this sense, scientists and engineers may both be considered technologists; the three fields are often considered as one for the purposes of research and reference.

The exact relations between science and technology in particular have been debated by scientists, historians, and policymakers since the late 20th century. The issue remains contentious – though most analysts resist the model that technology simply is a result of scientific research.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. How is it possible to define technology?

2. Can technology refer to the collection of tools, machinery, modifications, arrangements and procedures?

3. Technologies significantly affect human and other animal species' ability to control and adapt to their natural environments, don't they?

4. When did the human species' use of technology begin?

5. What happened after the prehistorical discovery of the ability to control fire?

6. Was the invention of the wheel useful for humans?

7. What kind of technological developments have lessened physical barriers to communication and allowed humans to interact freely on a global scale?

8. Has all technology been used for peaceful purposes?

9. What kind of movements criticize the pervasiveness of technology in the modern world?

10. Was it believed that the development of technology was restricted only to human beings?

11. When has the use of term *technology* changed significantly?

12. Before the 20th century, the term *technology* was uncommon in English, wasn't it?

13. Who translated ideas from German concept of Technik into "technology"?

14. In what languages does a distinction exist between the terms of *Technik* and *Technologie?*

2. Обратите внимание на сочетаемость слова *technology* с другими словами для образования различных терминов и дайте русские эквиваленты этих терминов:

$$\left.\begin{array}{r}\text{medical}\\ \text{space}\\ \text{communication}\end{array}\right\}\ \text{technology}$$

3. Расшифруйте следующие сокращения и переведите их на русский язык. Проверьте себя по ключу. (Приложение 6)

сокращение	развёрнутая форма	перевод
nanotech		
nsec		

4. Дайте русские эквиваленты следующих терминов:

nanogram, nanoatom, nanosurgery, nanoid, nannoplankton, nannofossil.

IV. Дополнительные тексты для просмотрового чтения с последующим переводом с листа

NANOTECHNOLOGY

Nanotechnology is manipulation of matter on an atomic and molecular scale. Generally, nanotechnology works with materials, devices, and other structures with at least one dimension sized from 1 to 100 nanometres. With a variety of potential applications, nanotechnology is a key technology for the future and governments have invested billions of dollars in its research.

Nanotechnology is very diverse, ranging from extensions of conventional device physics to completely new approaches based upon molecular self-assembly, from developing new material with dimensions on the atomic scale. Nanotechnology entails application of fields of science as diverse as surface science, organic chemistry, molecular biology, semiconductor physics, microfabrication, etc.

Scientists currently debate the future implications of nanotechnology. Nanotechnology may be able to create many new materials and devices with a vast range of applications, such as medicine, electronics, biomaterials and energy production. On the other hand, nanotechnology raises many of the same issues as any new technology, including concerns about the toxicity and environmental impact of nanomaterials, and their potential effects on global economy, as well as speculation about various doomsday scenarios. These concerns have led to a debate among advocacy groups and governments on whether special regulation of nanotechnology is warranted.

Materials reduced to the nanoscale can show different properties compared to what they exhibit on a macroscale, enabling unique applications. For instance, opaque substances become transparent (copper); stable materials turn combustible (aluminum); insoluble materials become soluble (gold). A material such as gold, which is chemically inert at normal scales, can serve as a potent chemical catalyst at nanoscales. Much of the fascination with nanotechnology stems from these quantum and surface phenomena that matter exhibits at the nanoscale.

CURRENT RESEARCH

Nanomaterials

The nanomaterials field includes subfields which develop or study materials having unique properties arising from their nanoscale dimensions.

- Interface and colloid science has given rise to many materials which may be useful in nanotechnology, such as carbon nanotubes and other fullerenes, and various nanoparticles and nanorods. Nanomaterials with fast ion transport are related also to nanoionics and nanoelectronics.
- Nanoscale materials can also be used for bulk applications; most present commercial applications of nanotechnology are of this flavor.
- Progress has been made in using these materials for medical applications.
- Nanoscale materials are sometimes used in solar cells which combats the cost of traditional Silicon solar cells.
- Development of applications incorporating semiconductor nanoparticles to be used in the next generation of products, such as display technology, lighting, solar cells and biological imaging.

NANOROBOTS

Nanorobots are just the adapted machine version of bacteria. Nanorobots measure six atoms across and are complicated to be designed and need to be engineered in such a way that they are autonomous in nature.

Nanorobots are small microscopic devices measured on the scale of nanometers. They are designed to function like bacteria or any normal virus. Nanorobots are small particles that have a small solar cell or some kind of battery. The nanorobots are made of tiny silicon pieces called as transducers. These transducers take in energy that is generated by the robot`s solar cell and turns the energy into mechanical power.

Nanorobots are the most useful objects that humans have invented. They are capable to rebuild the tissue molecules in order to close an open wound, rebuild the walls of ruptured veins and arteries and also find their way to the heart by travelling through your blood stream and perform important surgeries like heart molecular surgery without causing any discomfort to you.

Scientists are also of the opinion that nanorobots will help in brain research, cancer research and finding remedies for difficult ailments like AIDS, leukaemia and other major diseases.

NANOVEHICLES

Today, when you have an illness, you have to take medicine in several doses, as pills or syrups. Imagine a day when you have to take the drug only once, and it works a whole lot better. Nanotechnology can help do that.

Nanotechnology is the science of making devices that are very tiny, on the scale of one-millionth of a millimeter. This is the right size to build the vehicles that can deliver medicines to the right place in your body.

Chemists are searching for the ideal nanovehicle. This is one that would

- dramatically reduce the drug dosage;
- deliver the drug to the right place;
- increase the local concentration of the drug there;
- and limit or eliminate side effects.

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

STONE TOOLS

Human ancestors have been using stone and other tools since long before the emergence of *Homo sapiens* approximately 200,000 years ago. The earliest methods of stone tool making, known as the Oldowan "industry", date back to at least 2.3 million years ago, with the earliest direct evidence of tool usage found in Ethiopia within the Great Rift Valley, dating back 2.5 million years ago. This era of stone tool use is called the Paleolithic, or "Old stone age", and spans all of human history up to the development of agriculture approximately 12,000 years ago.

The earliest stone tools were crude, being little more than a fractured rock. In the Acheulian era, beginning approximately 1.65 million years ago, methods of working these stone into specific shapes, such as hand axes emerged. The Middle Paleolithic, approximately 300,000 years ago, saw the introduction of the prepared-core technique, where multiple blades could be rapidly formed from a single core stone. The Upper Paleolithic, beginning approximately 40 000 years ago, saw the introduction of pressure flaking, where a wood, bone, or antler punch could be used to shape a stone very finely.

METAL TOOLS

Continuing improvements led to the furnace and bellows and provided the ability to smelt and forge native metals (naturally occurring in relatively pure form). Gold, copper, silver, and lead, were such early metals. The advantages of copper tools over stone, bone, and wooden tools were quickly apparent to early humans, and native copper was probably used from near the beginning of Neolitic times (about 8000 BC). Native copper does not naturally occur in large amounts, but copper ores are quite common and some of them produce metal easily when burned in wood or charcoal fires. Eventually, the working of metals led to the discovery of alloys such as bronze and brass (about 4000 BC). The first of iron alloys such as steel dates to around 1400 BC.

MEDIEVAL AND MODERN HISTORY (300 AD -)

Innovations continued through the Middle Ages with innovations such as silk, the horse collar and horseshoes in the first few hundred years after the fall of the Roman Empire. Medieval technology saw the use of simple machines (such as the lever, the screw, and the pulley) being combined to form more complicated tools, such as the wheelbarrow, windmills and clocks. The Renaissance brought forth many of these innovations, including the printing press (which facilitated the greater communication of knowledge), and technology became increasingly associated with science, beginning a cycle of mutual advancement. The advancements in technology in this era allowed a more steady supply of food, followed by wider availability of consumer goods.

Starting in the United Kingdom in the 18th century, the Industrial Revolution was a period of great technological discovery, particularly in the areas of agriculture, manufacturing, mining, metallurgy and transport, driven by the discovery of steam power. Technology later took another step with the harnessing of electricity to create such innovations as the electric motor, light bulb and countless others. Scientific advancement and the discovery of new concepts later allowed for powered flight, and advancements in medicine, chemistry, physics and engineering.

The 20th and 21st centuries brought a host of innovations. In physics, the discovery of nuclear fission has led to both nuclear weapons and nuclear power. Computers were also invented and later miniaturized utilizing transistors and integrated circuits. The technology behind got called information technology, and these advancements subsequently led to the creation of the Internet, which ushered in the current Information Age. Humans have also been able to explore space with satellites (later used telecommunication) and in manned missions going all the way to the moon. In medicine, this era brought innovations such as open-heart surgery and later stem cell therapy along with new medications and treatments. Complex manufacturing and construction techniques and organizations are needed to construct and maintain these new technologies, and entire industries have arisen to support and develop succeeding generations of increasingly more complex tools. Modern technology increasingly relies on training and education.

THE USES OF PLASMAS

Micro-plasma welding is a method used to join paper thin sheets of metals. The joint becomes invisible after polishing. Stainless steel water storage tanks and other kitchen implements are made this way. Plasma spray process is a most magical use of thermal plasmas, it is the only coating process that can apply any material on to any material.

- Metal on to metal: Titanium on to mild steel, to prevent corrosion of steel.
- Non-metal on to metal: alumina on to stainless steel. Alumina reduces the wear and tear on the stainless steel vessel due to industrial processes.

- Metal on to non-metal: copper on to porcelain used in capacitors. Plasma-spraying copper onto the porcelain makes it 'solderable', so that electric wires can be attached to it.
- Non-metal on to non-metal: Teflon on to magnesia (ceramic). Some chemicals like hydrofluoric acid can corrode the ceramic vessels they are kept in; coating them with Teflon prevents corrosion.

SAFETY – A PRIMARY CONCERN

-1-

Chemical technology has brought us many useful products. They insulate our homes, make transportation safer and less expensive, help clothe and feed us, and enable us to enjoy better health. And yet with each product comes some potential risk. While many chemicals pose no special hazard, some can have harmful effects on our health or on our environment.

Sometimes we are not even aware of chemical hazards until a product has been used for some time. For example, parents with young children wanted sleepwear that would not burn easily. The chemical industry responded by producing a flame-retardant chemical called TRIS used to treat children’s pajamas. After TRIS had been in use for some time, it was discovered that it could cause cancer, and its use was discontinued.

In other instances, we may be aware of a risk but use a product anyway because its benefits outweigh its risks. Penicillin, for example, has saved many lives, but it also can kill people who are allergic to it. Doctors have been able to minimize the risk of using penicillin by carefully monitoring how patients react to it. In spite of these precautions, even today people occasionally die from a bad reaction to this antibiotic. But, as is true of penicillin, most people are usually willing to use a product if its risks are small and its benefits are potentially great.

-2-

The chemical industry in the United States has become increasingly concerned about eliminating chemical hazards. As a result of this concern, the industry steadily has improved its safety record. For the past decade, it has ranked either first or second among American industries in having the lowest frequency of job-related accidents.

The accidents that have occurred have been consistently among the least severe of all industries. The chemical industry, in fact, is so safe that its employees are nearly ten times more likely to have an accident while away from work than while on the job. In accordance to the above mentioned, major chemical companies are developing safety programs to protect workers during non-working hours. These programs focus on providing workers with information on how to avoid accidents. The improving record of the chemical industry shows that when people are well-informed and determined, they can live and work in a safe environment.

When concern for safety is a high priority, many accidents can be avoided and the severity of those accidents that do occur can be lessened.

INDUSTRIAL PRODUCTION OF OXYGEN

Oxygen is so important in many ways that it is made in large quantities in industry. Manufacturers have an abundant free supply of it in the air, and it is obtained by cooling the air until it becomes a liquid (just as steam condenses to water). This liquid air contains both liquid oxygen and liquid nitrogen, and when the temperature of the mixture is allowed gradually to rise it boils and the oxygen and nitrogen change back to gases. They do this, however, at different temperatures and can therefore be collected separately. Oxygen is stored under considerable pressure in steel cylinders painted black. Its release from the cylinder is controlled by a valve, and the gas can easily be obtained whenever it is required.

Для заметок

Урок 6
A Place of Discovery and Learning

I. Предтекстовые упражнения

1. Вспомните формы и значения английского причастия (Приложение 1, §9).

2. Обратите внимание на способы перевода английского причастия на русский язык (Приложение 1, §10) и используйте, где необходимо, эти способы при переводе текста урока.

3. Определите лексические соответствия и используйте предложенную лексику при переводе:

facility	пар
hazard	предосторожность
precaution	запах
vapor	объект
odor	опасность

4. Найдите в тексте слова с противоположным значением:

safety, dry, allow, hide, exit

5. Определите правильное место в предложении для находящегося в скобках слова:

By the nature of laboratory work, it can be a place of danger. *(very)*

6. Выберите правильное слово:

Despite the great differences among laboratories, some *feathers/features/fears* are common.

7. Вставьте пропущенное слово:

Rules exist to … the individual's risk.

8. Восстановите правильный порядок слов в предложении:

Scientists other use fields in types still laboratories will other of.

9. В предложении отсутствуют знаки препинания. Расставьте их и проверьте себя по тексту:

Laboratory hazards are as varied as the subjects of study in laboratories and might include poisons infectious agents flammable explosive or radioactive materials moving machinery extreme temperatures lasers strong magnetic fields or high voltage.

10. Найдите в словаре перевод следующих однокоренных слов:

=> experiment, experimental, experimentalist, experimentalize, experimentally, experimentation.

II. Текст

Запомните следующие слова и словосочетания

accumulate	eye-wash station	requirement
adhere to something	facilities	glassware
agent	fire extinguisher	burette
analysis of data collected	first-aid	safety goggles
apparatus	flammable	specific
approach to something	fumes	strictly prohibited
associated with	hazard	condenser
something	ventilator	pipette
authorize for something	inhale vapors	funnel
avoid	measurement	beaker
cause serious injury	occupational exposure	crucible
emergency	poison	burner
explosive	precautions	flask

LABORATORY

A laboratory is a facility that provides controlled conditions in which scientific research, experiments, and measurement may be performed. Scientific laboratories can be found in schools and universities, in industry, in government or military facilities, and even aboard ships and spacecraft. A laboratory might offer work space for just one to more than thirty researchers depending on its size and purpose.

Labs used for scientific research take many forms because of the differing requirements of specialists in the various fields of science. A physics lab might contain a particle accelerator or vacuum chamber, while a metallurgy lab could have apparatus for casting or refining metals or for testing their strength. A chemist or biologist might use a wet laboratory, while a psychologist's lab might be a room with one-way mirrors and hidden cameras in which to observe behavior. In some laboratories, such as those commonly used by computer scientists, computers (sometimes supercomputers) are used for either simulations or the analysis of data collected elsewhere. Scientists in other fields will use still other types of laboratories. Despite the great differences among laboratories, some features are common. The use of workbenches or countertops at which the scientist may choose to either sit or stand is a common way to ensure comfortable working conditions for the researcher, who may spend a large portion of his or her working day in the laboratory.

LAB SAFETY

In some laboratories, the conditions are no more dangerous than in any other room. In many labs, though, hazards are present. Laboratory hazards are as varied as the subjects of study in laboratories, and might include poisons; infectious agents; flammable, explosive, or radioactive materials; moving machinery; extreme temperatures; lasers, strong magnetic fields or high voltage. In laboratories where dangerous conditions might exist, safety precautions are important. Rules exist to minimize the individual's risk, and safety equipment is used to protect the lab user from injury or to assist in responding to an emergency.

The Occupational Safety and Health Administration (OSHA) in the United States, recognizing the unique characteristics of the laboratory workplace, has tailored a standard for occupational exposure to hazardous chemicals in laboratories. This standard is often referred to as the "Laboratory Standard". Under this standard, a laboratory is required to produce a Chemical Hygiene Plan (CHP) which addresses the specific hazards found in its location, and its approach to them.

CHEMISTRY LAB SAFETY

The chemistry laboratory can be a place of discovery and learning. However, by the very nature of laboratory work, it can be a place of danger if proper common-sense precautions aren't taken. While every effort has been made to eliminate the use of explosive, highly toxic, and carcinogenic substances from the experiments which you will perform, there is a certain unavoidable hazard associated with the use of a variety of chemicals and glassware. You are expected to learn and adhere to the following general safety guidelines to ensure a safe laboratory environment for both yourself and the people you may be working near.

Attire:

1. Safety goggles must be worn at all times while in the laboratory. This rule must be followed whether you are actually working on an experiment or simply writing in your lab notebook. You must wear safety goggles provided by the chemistry department.

2. Contact lenses are not allowed. Even when worn under safety goggles, various fumes may accumulate under the lens and cause serious injuries or blindness.

3. Closed toe shoes and long pants must be worn in the lab. Sandals and shorts are not allowed.

4. Long hair must be tied back when using open flames.

Conduct:

1. Eating, drinking, and smoking are strictly prohibited in the laboratory.

2. No unauthorized experiments are to be performed. If you are curious about trying a procedure not covered in the experimental procedure, consult with your laboratory instructor.

3. Never taste anything. Never directly smell the source of any vapor or gas; instead by means of your cupped hand, waft a small sample to your nose. Do not inhale these vapors but take in only enough to detect an odor if one exists.

4. Coats, backpacks, etc., should not be left on the lab benches and stools. There is a hook rack along the back wall at either end of the lab. There are coat racks just inside each entrance to the balance room at the back of the lab. Beware that lab chemicals can destroy personal possessions.

5. Always wash your hands before leaving lab.

6. Learn where the safety and first-aid equipment is located. This includes fire extinguishers, fire blankets, and eye-wash stations.

7. Notify the instructor immediately in case of an accident.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. What is a laboratory?
2. Where can scientific laboratories be found?
3. How many researchers might work in the laboratory?
4. Why do laboratories take many forms?
5. Could a metallurgy lab have apparatus for casting or refining metals or for testing their strength?
6. What kind of laboratory might be used by a chemist or biologist?
7. Why are computers used in some laboratories?
8. Despite the great differences among laboratories, some features are common, aren't they?
9. What is a common way to ensure comfortable working conditions for the researcher?

2. Обратите внимание на сочетаемость слова laboratory с другими словами для образования различных терминов и дайте русские эквиваленты этих терминов:

$$\left.\begin{array}{l}\text{computation}\\ \text{research}\\ \text{flying}\end{array}\right\}\ \text{laboratory}$$

3. Расшифруйте следующие сокращения и переведите их на русский язык. Проверьте себя по ключу. (Приложение 6)

сокращение	развёрнутая форма	перевод
BSc		
DNA		

4. Проверьте, можете ли вы правильно сформулировать по-английски правила поведения в лаборатории. Закончите предложения, встретившиеся вам в тексте урока:

⇒ Eating, drinking, and smoking are strictly …

⇒ Never directly smell the source of any …

⇒ Coats, backpacks, etc., should not …

⇒ Always wash your hands before …

⇒ Notify the instructor immediately …

IV. Дополнительные тексты для просмотрового чтения с последующим переводом с листа

LABORATORY OF THE ANALYTICAL CHEMISTRY

The chemical laboratory usually consists of one large room with a weighing room, a reagent room, and sometimes a dark room off it. The reagent room is used for storing chemicals and apparatus, and contains shelves of reagent bottles, winchesters and carboys of acid.

The weighing room is specially constructed so as to be free from external disturbances. The balances usually stand on firm stone shelves. For weighing accurately small quantities of materials a microbalance is used, and for some physical purposes, a spring balance.

The laboratory itself is fitted with benches, sinks, fume cupboards or hoods, electric drying ovens, and steam ovens.

The laboratory usually has facilities for glass blowing. Heating in the laboratory is generally done directly by the Bunsen burner. Microburners are used where a small flame is required, and Meker burners – where a large hot flame is necessary.

Test tubes stand in a test-tube rack; they are held above the flame in wooden holder and washed out with the help of a test-tube brush.

Solutions are heated in glass apparatus, such as beakers and flasks. Solids are usually heated in crucibles. Crucibles are fitted with lids.

The laboratory glassware includes: tubes, test-tubes, evaporating dishes, funnels, weighing bottles, beakers, flasks of different shape, bulbs, glass rods, stoppers for closing bottles, pipettes which are employed for removing measured quantities of liquids from other vessels. The lower end is contracted to a narrow opening. The glass vessels also include cylinders and burettes. A burette is a graduated glass tube, from which the liquid may be run by means of a tap at the bottom. All glass things are kept in special racks.

The laboratory is provided with different apparatus and devices. One of them, the desiccator, is used for drying materials. The condenser serves for cooling liquids and vapour. Every working place in the laboratory is supplied with a gas burner which serves for producing flames of different intensity. The burners are connected with the main gas line by a rubber tube. The flame of the burner can be regulated by a tap. Crucibles are used for igniting materials. They are made of different materials: iron, quartz, porcelain, clay, platinum, gold, etc.

Everything in the laboratory has a definite place. Near each bench there is a sink with running water and a stand with a towel and soap for washing hands. A large bottle with distilled water is placed on every bench since distilled water is necessary in almost every experiment. Powerful ventilators serve for purifying the air. They carry away harmful vapour and pungent odours. The ventillating hood also serves for carrying away laboratory fumes and disagreeable odours.

Every laboratory is provided with the most commonly used organic and inorganic reagents. Materials that occur in large crystals are ground to a more or less fine state in a mortar. The mortars are made of porcelain, iron, steel, or agate.

FROM CHEMICAL SCIENCE TO THE LAB

Profiles	Government agencies
Name	Paul Smith
Age	35
Job	Separation scientist

I studied Maths, Physics and Chemistry at A Level, then went on to do a BSc course in Chemistry with Physics at Plymouth Polytechnic. After graduating I moved to the University of Leeds to carry on my scientific studies with a PhD in Physical Chemistry.

My first job was a postdoctoral research position, also in Leeds. I was then offered a role as Head of the Analysis Laboratory at BHR Group Ltd, an independent group of technology companies specializing in fluid flow (e.g. water purification and waste disposal).

Finally, I moved to my current role as a Separation Scientist at the Laboratory of the Government Chemist (LGC), Europe’s largest independent analytical and diagnostic laboratory. LGC carries out chemical, biochemical and forensic analysis, DNA testing and genetic screening, research, method validation and consultancy.

As a Separation Scientist I separate a range of different types of compounds (pharmaceuticals, environmental contaminants, illegal drugs, etc.) from mixtures using several techniques, but mainly chromatography. I then have to identify the compounds, usually by using a spectroscopic technique such as mass spectrometry or ultra violet detection.

The job involves developing different assays or methods for separating and extracting the compound I am interested in.

For example, I have recently been working on a procedure for detecting cannabis in hair. Hair acts like a memory stick that stores information about everything a human has been doing. So, if somebody has been taking drugs on a regular basis then both the newest and the oldest bits of hair will contain traces of the drug. This is useful for Forensic Scientists as it tells them if somebody has been using drugs for a long time or has just taken them once.

LGC is a contract research organisation so it looks to find work from larger companies. Our sales staff visit other companies and sometimes invite a laboratory person, such as myself, along to answer some of the more technical questions. This is interesting as it allows me to see how other laboratories operate.

I enjoy working in a relaxed, friendly environment. The job is challenging and it is very rewarding when I am able to solve some quite tricky problems.

Although LGC does recruit some people with A Levels, all the staff at management level have a science degree. Having a science degree is a major benefit and allows quicker career progression as you already have a good deal of practical knowledge and are ready to apply it.

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

HOME CHEMISTRY LAB

How to set up a home chemistry lab

Chemistry is science that usually involves laboratory experiments and projects. You may want to set up a home chemistry lab to aid in your investigations. How do you do it? Here's some advice for setting up your own home chemistry lab.

1. Define Your Lab Bench

In theory, you could do your chemistry experiments anywhere, but if you live with other people you need to let them know which area contains projects which may be toxic or shouldn't be disturbed. There are other considerations, too, such as spill containment, ventilation, access to power and water, and fire safety. Common home locations for a chemistry lab include a garage, a shed, an outdoor grill and table, a bathroom, or a kitchen counter. I work with a fairly benign set of chemicals, so I use the kitchen for my lab. One counter is jokingly referred to as 'the counter of science'. Anything on this counter is considered off-limits by family members. It is a "do not drink" and "do not disturb" location.

2. Select Chemicals for Your Home Chemistry Lab

You're going to need to make decision. Are you going to work with chemicals which are deemed reasonably safe? Are you going to work with hazardous chemicals? There is a lot you can do with common household chemicals. Use common sense and adhere to any laws governing chemical use. Do you really need explosive chemicals? Heavy metals? Corrosive chemicals? If so, what safeguards will you put in place to protect yourself, your family, and the property from damage?

3. Store Your Chemicals

My home chemistry lab only includes common household chemicals, so my storage is pretty simple. I have chemicals in the garage (usually those which are flammable or volatile), under-sink chemicals (cleaners and some corrosive chemicals, locked away from kids and pets), and kitchen chemicals (often used for cooking). If you are working with more traditional chemistry-lab chemicals, then I recommend spending the money on a chemical storage cabinet and following storage recommendations listed on the chemicals. Some chemicals should not be stored together. Acids and oxidizers require special storage. Here's a list of chemicals which should be kept separate from each other.

4. Gather Lab Equipment

You can order the usual chemistry lab equipment from a scientific supply company that sells to the general public, but many experiments and projects can be conducted using home equipment, like measuring spoons, coffee filters, glass jars, and string.

5. Separate Home from Lab

Many of the chemicals you might use can be safely cleaned from your kitchen cookware. However, some chemicals pose too great a health risk (e.g., any compound containing mercury). You may wish to maintain a separate stock of glassware, measuring utensils, and cookware for your home lab. Keep safety in mind for clean-up, too. Take care when rinsing chemicals down the drain or when disposing of paper towels or chemicals after your experiment has been completed.

DISTILLATION

Distillation may be carried out simply in a retort or in a distillating flask connected through a condenser to a cooled receiver, often cooled by means of a freezing mixture in an ice bowl. In the Liebig condenser the vapour condenses in a long tube which is surronded by a water jacket in which the cold water circulates. The straem of cold water flows in at the bottom or cool end of the condenser and out at the top or hot end, so that the coolest part of the tube meets the coldest water, and as the water reaches the hotest part of the condenser, it is less cool. By this application of the counter-current principle a uniform temperature-drop along the condenser is ensured, and hence, as efficient cooling as possible. The distillate is collected in the receiver.

DRYING

A desiccator is a vessel in which a dry atmosphere can be maintained, and which can be made gas-tight. It is employed for a variety of purposes. Crucibles are allowed to cool, before weighing in the desiccator; weighing bottles containing substances for analysis may be kept therein; crystals may be dried, or liquids evaporated, especially in the vacuum form of apparatus. The drying agent, sulphuric acid with or without pumice, or anhydrous calcium chloride, is placed in the lower part of the vessel. Calcium chloride is preferable to a liquid in an apparatus which has to be carried to and fro, and for vacuum desiccators sulphuric acid should not be used. The drying of a solid substance may be assisted greatly by spreading it on a porous clay plate, especially if it is finely divided. The clay absorbs the water slowly; the drying may be further accelerated by placing the plate in the vacuum desiccator. Great care must be exercised in the drying of all substances which are affected by heat, as, e.g. salts containing water of crystallisation. Such bodies must be dried at low temperatures.

In washing and drying gases water may be used for removing soluble impurities which are themselves sparingly soluble in water. If the gas is soluble in water, its saturated solution may be employed to wash it. For drying, sulphuric acid is generally used.

Calcium chloride may also be used for drying most gases. For ammonia caustic potash or quicklime in small pieces may be used. For the most complete drying of gases phosphorous pentoxide is employed.

Liquids my be dried by the use of the above or other materials. The liquid and the desiccating agent are placed together in a dry flask, which is then tightly closed and allowed to stand for several hours to remove completely the moisture. Care must be taken to avoid the use of a dehydrating agent which is soluble in, or has a chemical action upon, the liquid to be dried. For example, basic liquids like aniline must not be dried with acid agents such as phosphorous pentoxide, nor yet with calcium chloride or zinc chloride.

PRECIPITATION

When we mix solutions containing two bodies which can, by interaction, produce another substance insoluble or little soluble in the solvent, then the new substance separates from the liquid in the form of a precipitate. Thus, when barium chloride and sodium sulphate are dissolved separately in water, and the solutions mixed, barium sulphate is at once separated as a white precipitate. It is practically insoluble in water.

Precipitation may take place slowly or rapidly, according as the precipitated substance is more or less soluble in the solvent. A change in the composition of the solvent often brings about precipitation or rapid crystallization. The rate of precipitation is often increased by vigorous stirring or shaking in a tightly stoppered precipitation jar. In all cases the solution should be constantly stirred while the precipitation is added, to ensure thorough mixing. A large excess of the precipitant should be avoided, when possible, to facilitate subsequent washing. A crystalline or granular precipitate is always more easily washed and filtered than a gelatinous one. Before proceeding to filter, the supernatant liquid, which is usually clear, should be tested with a few drops more of the precipitant, to make sure that precipitation is complete. It is advisable to allow the precipitate to settle, and to filter the clear liquid first. The precipitate may then be washed by decantation, that is by mixing it with fresh solvent and again allowing to settle.

Perfect washing of the precipitate is of the utmost importance. It may be partly done by decantation, but must be completed on the filter. The washing is continued until a few drops of a filtrate collected in a clean test-tube show no traces of impurities.

Для заметок

Урок 7
Reading the Periodic Table

I. Предтекстовые упражнения

1. Вспомните, что представляет собой независимый причастный оборот (абсолютная номинативная конструкция) в английском языке (Приложение 1, §11).

2. На примере предложения из текста проанализируйте значение и употребление независимого причастного оборота и правила его перевода на русский язык в зависимости от позиции (препозитивной или постпозитивной) в предложении:

> In 1863 there were 56 known elements *with a new element being discovered* at a rate of approximately one per year.

3. Проанализируйте предложение с препозитивным независимым причастным оборотом и сравните его перевод с переводом предыдущего предложения:

> *With the prices going higher,* it is becoming increasingly difficult to make both ends meet.

4. Измените, где это необходимо, порядок слов в предложении для восстановления смысла. Проверьте себя по тексту:

> The elements the most small are widely atomic diffused which have weights.

5. Определите правильное место в предложении для находящегося в скобках слова:

> We must expect the discovery of many unknown elements. *(yet)*

6. Выберите правильное слово:

> They both constructed their tables in a *similor/similar/simian* manner.

7. Вставьте пропущенное слово:

> The magnitude of the atomic weight determines the character of the element, just as the magnitude of the … determines the character of a compound body.

8. Одно из перечисленных слов является синонимом слова *concept*. Назовите это слово:

> concept: plan, thesis, illusion, idea, evidence, argument.

9. Запомните русские эквиваленты следующих слов и словосочетаний и используйте их при переводе текста:

by listing the elements – путём перечисления элементов

empty space – пустое пространство

to switch adjacent elements – поменять местами смежные (соседние) элементы

the orbital arrangement of electrons – расположение электронов на орбите

missing elements – недостающие элементы

10. Найдите в словаре перевод следующих однокоренных слов:

⇒ period, periodic(al), periodically, periodicity

II. Текст

Запомните следующие слова и словосочетания

according to something	discover	rate
arrange	exhibit	recognize
assist in something	identify	relative
attempt	pattern	similar
correspond to something	predict	valence or valency
criticize	property	virtually identical
atom	molecule	measure
	capacity	abundance

THE PERIODIC TABLE

In 1863 there were 56 known elements with a new element being discovered at a rate of approximately one per year.

Other scientists had previously identified periodicity of elements. John Newlands described a Law of Octaves, noting their periodicity according to relative atomic weight in 1864, publishing it in 1865. His proposal identified the potential for new elements such as germanium. The concept was criticized and his innovation was not recognised by the Society of Chemists until 1887. Another person to propose a periodic table was Lothar Meyer, who published a paper in 1864 describing 28 elements classified by their valence, but with no prediction of new elements.

After becoming a teacher, Mendeleev wrote the definitive textbook of his time: *Principles of Chemistry* (two volumes, 1868–1870). As he attempted to classify the elements according to their chemical properties, he too noticed patterns that led him to postulate his periodic table. Mendeleev was unaware of the earlier work on periodic tables going on in the 1860s. He made the following table, and by adding additional elements following this pattern, developed his extended version of the periodic table.

On 6 March 1869, Mendeleev made a formal presentation to the Russian Chemical Society, entitled *The Dependence between the Properties of the Atomic Weights of the Elements*, which described elements according to both atomic weight and valence. This presentation stated that

- The elements, if arranged according to their atomic weight, exhibit an apparent periodicity of properties.
- Elements which are similar regarding their chemical properties have atomic weights which are either of nearly the same value (e.g., Pt, Ir, Os) or which increase regularly (e.g., K, Rb, Cs).
- The arrangement of the elements in groups of elements in the order of

their atomic weights corresponds to their so-called valencies, as well as, to some extent, to their distinctive chemical properties; as is apparent among other series in that of Li, Be, B, C, N, O, and F.

- The elements which are the most widely diffused have small atomic weights.
- The magnitude of the atomic weight determines the character of the element, just as the magnitude of the molecule determines the character of a compound body.
- We must expect the discovery of many yet unknown elements – for example, two elements, analogous to aluminium and silicon, whose atomic weights would be between 65 and 75.
- The atomic weight of an element may sometimes be amended by a knowledge of those of its contiguous elements.
- Certain characteristic properties of elements can be foretold from their atomic weights.

Mendeleev published his periodic table of all known elements and predicted several new elements to complete the table. Only a few months after, Meyer published a virtually identical table.

They both constructed their tables in a similar manner by listing the elements in a row or column in order of atomic weight and starting a new row or column when the characteristics of the elements began to repeat. The success of Mendeleev's table came from two decisions he made. The first was to leave empty spaces in the table when it seemed that the corresponding element had not yet been discovered. Mendeleev was not the first chemist to do so, but he was the first to be recognized as using the trends in his periodic table to predict the properties of those missing elements, such as gallium and germanium. The second decision was to ignore the order suggested by the atomic weights and switch adjacent elements, such as cobalt and nickel, to better classify them into chemical families. With the development of theories of atomic structure, it became apparent that Mendeleev had listed the elements in order of increasing atomic number.

There are many ways the Periodic Table can be used. The table can be used to find the atomic number. The atomic weight is also indicated in the table. The orbital arrangement of electrons is shown for each of the elements. The common oxidation states are given. For most elements these numbers are the same as the valence numbers.

The table enables us to recognize families of elements. And at last the table can be used to predict the properties of the elements. The fact that the Periodic Table can assist in predicting properties of elements has helped in the discovery of missing elements.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. Who described a Law of Octaves?

2. What happened in 1865?

3. John Newlands' proposal identified the potential for new elements such as germanium, didn't it?

4. Was John Newlands' concept criticized?

5. Did Lothar Meyer publish a paper describing 28 elements classified by their valence?

6. When were two volumes of *Principles of Chemistry* written by Mendeleev?

7. What was the title of Mendeleev's formal presentation in 1869?

8. What was described in Mendeleev's formal presentation to the Russian Chemical Society?

9. Mendeleev predicted several new elements to complete the table, didn't he?

10. What kind of decisions were made by Mendeleev?

11. Mendeleev was the first to be recognized as using the trends in his periodic table to predict the properties of gallium and germanium, wasn't he?

12. Are there many ways the Periodic Table can be used?

13. The table enables us to recognize families of elements, doesn't it?

14. Can the table be used to predict the properties of the elements?

2. Обратите внимание на сочетаемость слова *element* с другими словами для образования различных терминов и дайте русские эквиваленты этих терминов:

$$\left.\begin{array}{r}\text{chemical}\\ \text{detecting}\\ \text{earthy}\\ \text{sensitive}\\ \text{thermal}\\ \text{trace}\end{array}\right\}\ \text{element}$$

3. Расшифруйте следующие сокращения и переведите их на русский язык. Проверьте себя по ключу.(Приложение 6)

сокращение	развёрнутая форма	перевод
class.		
V. (=vol.)		
e.g.		

4. Переведите на русский язык латинское выражение *per annum* и вспомните его синоним из текста.

IV. Дополнительные тексты для просмотрового чтения с последующим переводом с листа

HISTORICAL BACKGROUND OF ELEMENTS

We meet the idea of an element very early in our study of chemistry. The ancients suspected that there must be some very simple substances from which more complicated ones were built. At one time they thought that everything might be made up of earth, air and water; these got the name "element" which comes from the same word as "elementary" or simple.

This idea, though wrong, is still a rather important one. The first man to recognize the modern type of element was Robert Boyle in the middle of seventeenth century. His idea was that an element was just something which could not be broken down chemically into anything simpler. He knew of metals like iron, copper, tin, lead, gold and silver and non-metals like carbon and sulphur, all the gases being called "air". In the years since Boyle first defined an element in the modern sense over one hundred different ones have been defined. Some of these are rather common and well-known but quite a lot are man-made. Examples are mendeleyevium, nobelium and lawrencium. One of the first distinctions between elements was the division into metals and non-metals.

One may be able to devise other ways of distinguishing metals from non-metals. We have seen that a dull-red mercuric oxide is decomposed into mercury and oxygen. The weights of oxygen and mercury obtained are together equal to the weight of mercuric oxide. Similarly, water is decomposed by electrolysis into oxygen and hydrogen. No chemist, however, has been able to separate any other substances from mercury, oxygen or hydrogen: these three substances are known, therefore, as elements. An element is a substance which, so far as is known, contains only one kind of atom. It has been found possible to resolve all known substances into about 117 elements: many of these elements are rare, and relatively few are common in nature.

Astronomers have found that the same elements which are common on Earth, e.g. nitrogen, carbon and hydrogen, are also the commonest in the Sun and other stars. Thus elements are the primary building materials of the Universe.

QUESTIONS ON CHEMISTRY

What is an atom?

An atom is made up of a dense central nucleus that consists of positive protons and neutral neutrons bound together by an electromagnetic force. This nucleus is enveloped in a cloud of negatively charged electrons. When a group of atoms bind with each other they form a molecule.

Where do you find an atom?

All elements are made out of atoms. What's more all the atoms of an element are completely identical. However you should note that atoms of different elements are completely different. Atoms of different elements can come together to form compounds. What is interesting is when there is a chemical reaction, atoms are not made, destroyed or changed. You are always left with the same number of atoms that you had at the beginning of the reaction.

How much do they weigh?

You may wonder how heavy these building blocks weigh. An Italian chemist called Amadeo Avogadro did. While doing research on gases, Avogadro realised that it was possible to measure the ratio of the atomic masses. What this meant was that if he measured a litre of oxygen and found that it was 16 times more than that of hydrogen, then it could be assumed that the atomic mass of oxygen was 16 times more than hydrogen.

Based on atomic weight, and using carbon as a standard atomic weight a relative scale of elements could be created by Avogadro. Yet it was Dmitri Mendeleev, a Russian chemist who invented the first periodic table which lists out elements by increasing atomic mass.

What is the relation between the number of protons and the number of electrons in an atom?

All atoms are electrically neutral. Since protons are positively charged and electrons are negatively charged they must equal each other if the atom is to remain neutral.

Therefore, in any atom the number of protons must equal the number of electrons. Thus a hydrogen atom has one proton and one electron.

What is meant by the atomic weight of an element?

a) The number of protons in any atom equals the number of electrons in that atom. This number is used to identify an element and is called the atomic number of the element. For example, the atomic number of hydrogen, which has one proton, is 1. The atomic number of helium, which contains two protons, is 2, and so on.

b) Although all atoms have weight, the weights, in usual terms, are very,

very small. Therefore, to avoid using minute quantities, numbers expressing the comparative weights of atoms are used. These numbers are called the atomic weights of elements. They are not actual weights of atoms but are comparisons of actual weights with the weight of the standard atom set at arbitrary number.

Atomic weights were based on a standard which is ^{12}C.

Can the same element have different atomic weights?

Atoms of the same element often have different atomic weights. These differences are due to differences in the number of neutrons in their nuclei. When atoms of the same element have different weights they are called isotopes of the element. This difference in atomic weight does not change the chemical properties but it does have an effect upon the nuclear properties of the atom or its radioactivity.

MOLECULES

As an atom is the smallest part of an element, and as a compound must contain at least two elements, it follows that the smallest part of a compound that can exist must contain at least two different atoms. This is called a molecule. Although the atoms of elements take part in chemical reactions, they very often do not normally exist as single atoms when they are free. The atoms of such gases as oxygen, hydrogen, nitrogen and chlorine may be considered as very friendly ones, as they almost always occur in pairs, each pair forming a molecule, the smallest particle able to exist alone. On the other hand, the atoms of such gases as argon, helium and neon seem to prefer to remain alone. As the molecules of these gases contain only one atom, they are said to be monoatomic in contrast to the former which are diatomic.

Some compounds are so complex that a single molecule may contain several hundreds of atoms and be quite large in comparison with a molecule of hydrogen, the smallest of all. It is possible to take photographs showing the way in which such large molecules are made up by means of a special type of microscope called an electron microscope, but these molecules are still too small to be seen through the most powerful of optical microscopes.

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

THE THEORIES OF PERIODIC TABLE

During the nineteenth century, many chemists tried to arrange the elements in an order which related to the size of their atoms and also showed regular repeating patterns in their behaviour or properties. The most successful attempt was published by the Russian, Dmitri Mendeleev, in 1869, and still forms the basis of the modern periodic table.

Periodic table

Both the physical properties and chemical properties of an element and its compounds are related to the position of the element in the periodic table. This relationship has led to the table being divided into groups and periods. The arrangement of the elements starts on the left of period 1 with hydrogen and moves in order of increasing atomic number from left to right across each period in turn.

Period

A horizontal row of elements in the periodic table. There are seven periods in all. Period 1 has only two elements - hydrogen and helium. Periods 2 and 3 each contain eight elements and are called the short periods. Periods 4, 5, 6 and 7 each contain between 18 and 32 elements. They are called the long periods. Moving from left to right across a period, the atomic number increases by one from one element to the next. Each successive element has one more electron in the outer shell of its atoms. All elements in the same period have the same number of shells, and the regular change in the number of electrons from one element to the next leads to a fairly regular pattern of change in the chemical properties of the elements across a period.

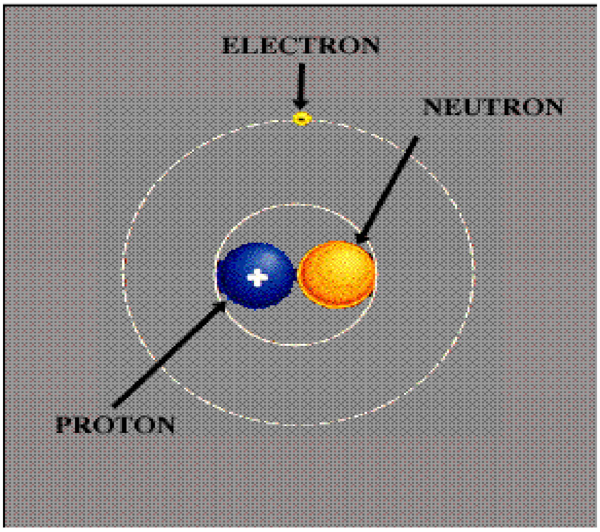
ATOMIC STRUCTURE

Matter is composed of tiny particles called atoms. The atom is a complex unit of various particles, the most important of which are electrons, protons, and neutrons. These particles have different properties. Electrons are tiny, very light particles that have a negative electrical charge (-). Protons are much larger and heavier than electrons and have the opposite charge, protons have a positive charge. Neutrons are large and heavy like protons, however neutrons have no electrical charge. Each atom is made up of a combination of these particles.

The differences between atoms of different elements are due to differences in the number of protons and neutrons in the nucleus and to differences in the arrangement of the electrons surrounding the nucleus. The mass of the atom is concentrated almost entirely in the nucleus.

The chemical properties of different elements can be explained by the structure of the atom. Chemical changes involve a shifting of outer (valence) electrons so that a shell is achieved. The activity of metals and non-metals is related to the size of the atom and to the number of electrons in the external orbit.

The valence or combining capacity of an atom is determined by the number of electrons it gains, loses or shares in chemical combinations with atoms of other elements. Atoms also may be joined to other atoms by sharing pairs of electrons. This process produces covalent compounds. These are generally gases or liquids with low boiling points. Oxidation involves the loss of electrons by the element. The process is accompanied by an algebraic increase in valence. Reduction, on the other hand, involves a gain of electrons by the substance reduced. This process is accompanied by an algebraic decrease in valence.



SILICON

The element silicon is second to oxygen in abundance in the crust of the earth, of which it constitutes about 28 per cent. It never occurs free, but only in combination with oxygen or with oxygen and metals in the silicate minerals, which compose most of the earth's crust.

Quartz is a crystalline form of silicon dioxide, SiO2, commonly called silica. On forming by slow deposition from solution in water during centuries, it is crystallized. At other times the silica by separating from solution as a colourless gel is gradually dried and compacted into flint. Flint is found in clay beds in all parts of the world.

Living organisms sometimes employ calcium carbonate and sometimes silica as a skeleton or supporting structure. Silica is plentiful, too, in most grasses and cereals. The fibers of bamboo have much silica, and the feathers of certain birds may have about 40 per cent silica. Even the human body contains minute amounts of silica.

Урок 8
Pride of Russian Science

I. Предтекстовые упражнения

1. Вспомните, в каких функциях может употребляться инфинитив в английском предложении (Приложение 1, §12).

2. В тексте урока инфининив встречается в трёх функциях: *прямого дополнения* к глаголу*, обстоятельства результата* и *определения*. Определите, какому предложению соответствует каждая из этих функций и переведите предложения на русский язык с учётом правил перевода инфинитива. (Приложение 1, §10)

⇒ Using the table, he predicted the properties of elements yet *to be discovered*.

⇒ The Nobel Committee for Chemistry recommended to the Swedish Academy *to award* the Nobel Prize in Chemistry for 1906 to Mendeleev.

⇒ He was not awarded it because of the argument that the periodic system was too old *to acknowledge* its discovery in 1906.

3. На примере предложения из текста покажите разницу между письменной и устной формой обозначения дат (Приложение 1, §13):

He resigned from Saint Petersburg University *on 17 August* 1890.

4. Образуйте существительные от следующих глаголов, дайте их русские эквиваленты и используйте эти эквиваленты при переводе:

английский глагол	английское существительное	русский эквивалент
contribute		
think		
introduce		
argue		
discover		

5. Определите правильное место в предложении для находящегося в скобках слова:

Though Mendeleev was honored by scientific organizations all over Europe, he resigned from the University. *(widely)*

6. Выберите правильное слово:

He *transcribed/transacted/transformed* Saint Petersburg into an internationally recognized center for chemistry research.

7. Вставьте пропущенное слово:

He was elected a … of the Royal Academy of Sciences.

8. Приведённые ниже английские словосочетания можно использовать для характеристики личности человека или его статуса. Найдите им русские соответствия и воспользуйтесь ими при переводе текста:

⇒ a chemist of genius

⇒ first-class physicist

⇒ a fruitful researcher

⇒ a thorough expert

⇒ an original thinker

9. Обратите внимание на несоответствие русских и английских предлогов в следующих случаях:

вклад *в* …	contribution *to* …
эксперт (специалист) *в* …	expert *of* …
в возрасте …	*at* the age of …

10. Найдите в словаре перевод следующих однокоренных слов:

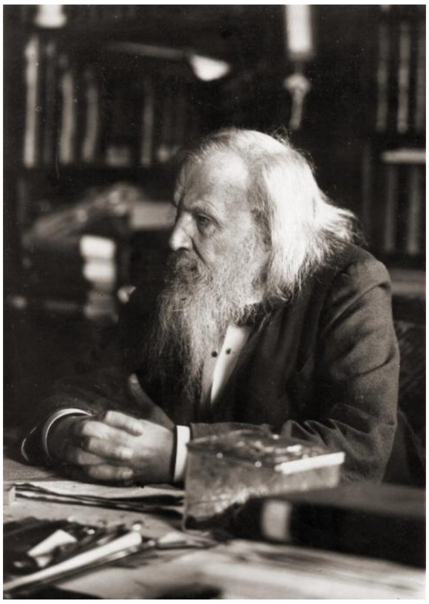
⇒ invent, inventor (=inventer), invention, inventive, inventiveness

II. Текст

Запомните следующие слова и словосочетания

acknowledge	contribute to something	invent
adjacent fields	found	resign
award	introduce something to something	thorough

DMITRI MENDELEEV



Dmitri Mendeleev in 1897.

Born: Dmitri Ivanovich Mendeleev, 8 February 1834, Verkhnie Aremzyani, Russian Empire.

Died: 2 February 1907 (aged 72), St. Petersburg, Russian Empire.

Nationality: Russian.

Fields: Chemistry, physics and adjacent fields.

Alma mater: Saint Petersburg University.

Notable students: Dmitri Petrovich Konovalov, Valery Gemilian, Alexander Baykov.

Known for: Inventing the Periodic table of chemical elements.

Dmitri Ivanovich Mendeleev was a Russian chemist and inventor. He created the first version of the periodic table of elements. Using the table, he predicted the properties of elements yet to be discovered.

Mendeleev made other important contributions to chemistry. The Russian chemist and science historian Lev Chugaev characterized him as "a chemist of genius, first-class physicist, a fruitful researcher in the fields of hydrodynamics, meteorology, geology, certain branches of chemical technology (explosives, petroleum, and fuels, for example) and other disciplines adjacent to chemistry and physics, a thorough expert of chemical industry and industry in general, and an original thinker in the field of economy." Mendeleev was one of the founders, in 1869, of the Russian Chemical Society. He transformed Saint Petersburg into an internationally recognized center for chemistry research.

Mendeleev worked on the theory and practice of protectionist trade and on agriculture. Also he is given credit for the introduction of the metric system to the Russian Empire.

Though Mendeleev was widely honored by scientific organizations all over Europe, he resigned from Saint Petersburg University on 17 August 1890.

In 1905, Mendeleev was elected a member of the Royal Swedish Academy of Sciences. The following year the Nobel Committee for Chemistry recommended to the Swedish Academy to award the Nobel Prize in Chemistry for 1906 to Mendeleev for his discovery of the periodic system. However, he was not awarded it because of the argument that the periodic system was too old to acknowledge its discovery in 1906.

In 1907, Mendeleev died at the age of 72 in Saint Petersburg from influenza.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. When and where was D.I. Mendeleev born?

2. What did Mendeleev create?

3. Mendeleev predicted the properties of elements yet to be discovered, didn’t he?

4. What kind of contributions to chemistry were made by Mendeleev?

5. Was he one of the founders of the Russian Chemical Society?

6. Did he transform Saint Petersburg into an internationally recognized center for chemistry research?

7. Who introduced the metric system to the Russian Empire?

8. When did Mendeleev resign from Saint Petersburg University?

9. Was Mendeleev elected a member of the Royal Swedish Academy of Sciences in 1890 or in 1905?

10. What happened in 1906?

2. Помимо *периодической таблицы Менделеева (periodic table)* запомните русско-английские соответствия названий некоторых других таблиц:

conversion (=equivalent)			пересчёта (перевода мер)
integral			интегралов
multiplication	table	таблица	умножения
mortality			статистическая таблица
			смертности
numerical			чисел

3. С помощью таблицы химических элементов проверьте, правильно ли вы пишете и произносите их по-английски (Приложение 2).

ТАБЛИЦА ХИМИЧЕСКИХ ЭЛЕМЕНТОВ

Ac	Be	Cm	F	Hg	Lu	Ni	Pr	Se	Ti
Ag	Bi	Co	Fe	Ho	Md	No	Pt	Si	Tl
Al	Bk	Cr	Fm	In	Mg	Np	Pu	Sm, Sa	Tu, Tm
Am	Br	Cs	Fr	Ir	Mn	O	Ra	Sn	U
Ar, A	C	Cu	Ga	J, I	Mo	Os	Re	Sr	V
As	Ca	Dy	Gd	K	N	P	Rh	Ta	W
At	Cd	Em	Ge	Kr	Na	Pa	Rz	Tb	Xe
Au	Ce	Er	H	La	Nb	Pb	S	Te	Y, Yt
B	Cf	Es	He	Lw	Nd	Pd	Sb	Te	Yb
Ba	Cl	Eu	Hf	Li	Ne	Pm	Sc	Th	Zn
									Zr

4. Определите, правильны ли следующие утверждения. Проверьте себя по тексту:

⇒ Mendeleev created the third version of the periodic table of elements.

⇒ Mendeleev was one of the founders, in 1873, of the Russian Chemical Society.

⇒ Mendeleev was given credit for the introduction of the metric system to Russia.

⇒ Mendeleev was elected a member of the Royal British Academy of Sciences.

⇒ Mendeleev was an outstanding Russian chemist and inventor.

IV. Дополнительный текст для просмотрового чтения с последующим переводом с листа

COMMEMORATION

A number of places and objects are associated with the name and achievements of Dmitri Mendeleev.

In Saint Petersburg his name was given to the National Metrology Institute dealing with establishing and supporting national and worldwide standards for precise measurements.

In the Twelve Collegia building, now being the centre of Saint Petersburg State University and in Mendeleev's time – Head Pedagogical Institute – there is Dmitri Mendeleev's Memorial Museum Apartment with his archives. The street in front of these is named after him as Mendeleevskaya liniya (Mendeleev Line).

In Moscow there is D. Mendeleev University of Chemical Technology of Russia.

After him was also named mendelevium, which is a synthetic chemical element with the symbol Md (formerly Mv) and the atomic number 101. It is a metallic radioactive transuranic element in the actinide series, usually synthesized by bombarding einsteinium with alpha particles.

A large lunar impact crater Mendeleev that is located on the far side of the Moon, as seen from the Earth, also bears the name of the scientist.

Russian Academy of Sciences yearly awards since 1998 Mendeleev Golden Medal (originally started by USSR Academy of Sciences in 1962) for achievements in chemical science and technology.

Mendeleev medal

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

MENDELEEV UNIVERSITY OF CHEMICAL TECHNOLOGY OF RUSSIA (MUCTR)

In 1898 Moscow Industrial School was founded. It was a new type of an educational institution at that time. In 1902, when the construction of the specially designed building was completed, the Industrial School moved to Miusskaya Square. The Mendeleev Institute was founded in 1920 on the basis of Moscow Industrial School. Since that time it has grown into a famous university. There are 13 faculties and several colleges: Higher College of Chemical Engineering, Russian Academy of Science Higher Chemical College and International Higher College of Information Computer Systems. About 6000 students (including foreign) and 400 postgraduates and trainees are studying at the Mendeleev University now. Its graduates are outstanding scientists, politicians, leaders of research centres and industrial enterprises, famous businessmen, showmen and bankers.

A lot of Members and Associate Members of the Russian Academy of Science, professors work at the Mendeleev University. It is acknowledged as an international centre of chemistry and chemical technology. Its main recent scientific developments are new environmentally safe chemical processes, composite and engineering materials based on polymers and silicates and materials applicable in various branches of science and industry.

Major courses are:

- Chemical Technology of Carbonaceous Materials
- Chemical Technology of Plastics
- Chemistry and Technology of Polymeric Film-Forming Materials
- Petrochemical Synthesis
- Chemical Technology of Organic Dyes
- Chemical Technology of Ceramics and Refractories
- Chemical Technology of Glass and Glassceramics
- Technology of Inorganic Substances
- Technology of Electrochemical Productions
- Chemical Physics and Technology of Nitrogen Compounds
- Chemistry and Technology of Macromolecular Compounds

- Chemistry and Technology of Organic Synthesis
- Technology of Isotopes and Pure Substances
- Radioecology and Chemistry of High Energy
- Technology of Rare and Dispersed Elements
- Chemical Technology of Materials for Quantum
- Electronics and Electronic Devices
- Cybernetics of Chemical Processes
- Production Automatics
- Computer Systems in Chemistry and Chemical Technology
- Industrial Ecology
- Technology of Biosphere Protection
- Industrial Biotechnology
- Material Technology and Production Engineering of New Materials
- Membrane Technology
- Chemistry Teaching
- Marketing
- Management
- Sociology

SCIENTIFIC WORK IN MENDELEEV UNIVERSITY OF CHEMICAL TECHNOLOGY OF RUSSIA (MUCTR)

The research carried out in Mendeleev University of Chemical Technology of Russia (MUCTR) involves just about all branches of chemistry, chemical technology, biotechnology, as well as a lot of divisions of knowledge having nothing with chemistry. One of the priority lines is energy resource saving and chemical technology safety.

Creating inorganic materials of the new generation is given priority as well. The scientists of Mendeleev University develop modern technologies of construction materials. One of them is synthetic granite sygran. It is highly competitive with the natural materials in its mechanical properties. Glass ceramics are used for decorating in constructing. The scientists were awarded the State Prize for advances in making the materials.

The research works in the field of making materials for nuclear energy industry have been carried out in the University since 1949. The first work in this direction includes that of academicians Kurchatov and Zhavoronkov. Nowadays the scientists of the University keep on dealing with the problems of nuclear power engineering safety.

The achievements in the field of rare-earth and dissimilar metals are particularly concerned with rhenium, zirconium, and hafnium.

The scope of zirconium application is wide enough. It is used in the power engineering for making fuel elements of nuclear power plants and for making modern kinds of ceramics. It is going to be applied in making ceramics for cylinders of internal-combustion engines as well as for making jewellery finets.

More than 300 textbooks have been published. Mendeleev University carries out research works under the programs designed in the Department of education of the Russian Federation. MUCTR has been assigned to be at the head of the major ‘Chemical Technologies’ program.

The scientists of Mendeleev University solve the problems of removing organic and inorganic compounds and heavy metal components from wastewater. They also solve the questions of nuclear power plant sewage purification and water treatment for thermoelectric power stations as well as drinking water purification. Advantages of the method are evident. Power inputs are the lowest, chemical reagents are not used in this case. It makes possible to reuse the purified water. The wastewater purification techniques have been applied in more than 60 Russian and foreign enterprises.

Mendeleev University of Chemical Technology of Russia has been directing the work of chemistry and applied chemistry Head Council attached to Ministry of Education of Russia. It involves 101 universities from all regions of our country. Conferences on an exchange of experience, seminars of young scientists take place regularly. There are joint publications. Head Council is a coordinator of the fundamental research work of the University.

More than 15 research schools of scientists being up to world standard work in MUCTR to date. Among them there are: theory of chemistry; theory of applied chemistry; inorganic materials of new generation; polymeric materials; new industrial processes and devices for environmental protection; inorganic substances and electrochemical processes; organic substance synthesis; materials for nuclear power engineering; energy-saturated materials and goods.

Priority lines of research work at the university:

Energy and resource-saving technologies; Inorganic materials of the new generation; Chemistry and technology of Polymers;Varnishes and paints, film-forming materials; Composite and structural materials; Petrochemistry and oil refining; Membrane technologies; Materials and technologies for atomic industry; Construction materials, finishing and decorative materials; Materials for medicine and health protection; Biotechnology; environmental protection; Nanotechnologies; Technology of inorganic substances and electrochemical changes; Energy saturated materials and compositions; Materials for electronic engineering; Sustainable development problems; Industrial safety; Information technologies.

Урок 9
Chemical Engineering

I. Предтекстовые упражнения

1. Вспомните, что собой представляет английский комплекс с инфинитивом, и какие инфинитивные комплексы вам известны

(Приложение 1, §14).

2. На примере следующих предложений из текста определите название инфинитивного комплекса и его функцию (Приложение 1, §§ 15, 16, 17). Переведите предложения на русский язык:

⇒ Some would consider an oil refinery to be a chemical plant.

⇒ It is possible for some units to operate continuously.

⇒ If a process appears to be profitable, then other factors are considered.

3. Предложения с комплексом “Именительный падеж с инфинитивом” и глаголом в страдательном залоге могут быть преобразованы в предложения с комплексом “Объектный падеж с инфинитивом” с глаголом в действительном залоге (и обратно). Определите, в каком из трёх предложений предыдущего упражнения возможны подобные преобразования и выполните эти преобразования.

4. Определите значения следующих глаголов в инфинитивной форме и используйте эти значения в нужной форме при переводе:

to manufacture, to locate, to establish, to eliminate, to convert, to commercialize

5. Определите правильное место в предложении для находящегося в скобках слова:

During this solution process cost studies are used as an initial screening to eliminate unprofitable designs. *(typically)*

6. Выберите правильное слово:

Today, the fundamental *prospects/aspects/suspects* of designing chemical plants are done by chemical engineers.

7. Вставьте пропущенное слово:

Chemical plants typically use … processes.

8. Уберите из предложения лишнее слово:

Chemical plants use special equipment, units, posters and technology in the processes.

9. В предложении отсутствуют знаки препинания. Расставьте их и проверьте себя по тексту:

In continuous operation all steps are ongoing continuously in time.

10. Найдите в словаре перевод следующих однокоренных слов:

=> industrial, industrialist, industrialized, industrially, industry

II. Текст

Запомните следующие слова и словосочетания

although	fluid	process
approximate	haphazard	profit
batch	initial	raw material
beverage	manufacture	remove
capacity	natural gas	sensitive
consider factors	nowadays	simultaneous
constraints	oil refinery	typically
continuous	on a large scale	unprofitable
costs	otherwise	utilize
efficient	petrochemical	via something
eliminate	pollute	

CHEMICAL PLANT

A chemical plant is an industrial process plant that manufactures (or otherwise processes) chemicals, usually on a large scale. The general objective of a chemical plant is to create new material wealth via the chemical or biological transformation and/or separation of materials. Chemical plants use special equipment, units, and technology in the processes. Other kinds of plants, such as polymer, pharmaceutical, food, and some beverage production facilities, power plants, oil refineries or other refineries, natural gas processing and biochemical plants, water and wastewater treatment, and pollution control equipment use many technologies that have similarities to chemical plant technology such as fluid systems. Some would consider an oil refinery or a pharmaceutical or polymer manufacturer to be effectively a chemical plant.

Petrochemical plants (plants using petroleum as a raw material) are usually located adjacent to an oil refinery to minimize transportation costs for the feedstocks produced by the refinery. Specialty chemical plants are usually much smaller and not as sensitive to location. Nowadays, sorts of tools were developed for converting a base project cost from one geographic location to another.

Chemical plants typically use chemical processes, which are detailed industrial-scale methods, to produce the chemicals. The same chemical process can be used at more than one chemical plant, with possibly differently scaled capacities at each plant. Also, a chemical plant at a site may be constructed to utilize more than one chemical process.

Chemical processes may be run in continuous or batch operation. Batch operation is commonly used in smaller scale plants such as pharmaceutical or specialty chemicals production.

In continuous operation, all steps are ongoing continuously in time. During usual continuous operation, the feeding and product removal are ongoing streams of moving material, which together with the process itself, all take place simultaneously and continuously. Chemical plants or units in continuous operation are usually in a steady state or approximate steady state. Steady state means that quantities related to the process do not change as time passes during operation. Such constant quantities include stream flow rates, heating or cooling rates, temperatures, pressures, and chemical compositions at every point (location). Continuous operation is more efficient in many large scale operations like petroleum refineries. It is possible for some units to operate continuously and others be in batch operation in a chemical plant.

Today, the fundamental aspects of designing chemical plants are done by chemical engineers, although historically this was not always the case and many chemical plants were constructed in a haphazard way before the discipline of Chemical Engineering became established. In plant design, typically less than 1 per cent of ideas for new designs ever become commercialized. During this solution process, typically, cost studies are used as an initial screening to eliminate unprofitable designs. If a process appears to be profitable, then other factors are considered, such as safety, environmental constraints, controllability, etc. The general goal in plant design, is to construct or synthesize “optimum designs” in the neighborhood of the desired constraints.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. How can a chemical plant be defined?
2. What is the general objective of a chemical plant?
3. Do chemical plants use special equipment?
4. Is it possible to consider an oil refinery or a pharmaceutical or polymer manufacturer to be effectively a chemical plant?
5. Where are petrochemical plants usually located?
6. Nowadays, sorts of tools were developed for converting a base project cost from one geographic location to another, weren't they?
7. Can the same chemical process be used only at one special plant or at more than one chemical plant?
8. Where is batch operation commonly used?
9. What happens during usual continuous operation?
10. Steady state means that quantities related to the process do not change as time passes during operation, doesn't it?
11. What is the general goal in plant design?

2. Обратите внимание на сочетаемость слова *process* с другими словами для образования различных терминов и дайте русские эквиваленты этих терминов:

$$\left.\begin{array}{r}\text{chemical}\\ \text{industrial}\\ \text{batch}\\ \text{inverse}\\ \text{reversible}\\ \text{irreversible}\\ \text{multistage}\\ \text{solution}\end{array}\right\}\ \text{process}$$

3. Восстановите начало следующих предложений. Проверьте себя по тексту:

⇒ … means that quantities related to the process do not change as time passes during operation. (2 слова)

⇒ … are usually much smaller and not as sensitive to location. (3 слова)

⇒ … used in smaller scale plants such as pharmaceutical or specialty chemicals production. (4 слова)

⇒ … in many large scale operations like petroleum refineries. (5 слов)

IV. Дополнительные тексты для просмотрового чтения с последующим переводом с листа

PLANT FACILITIES

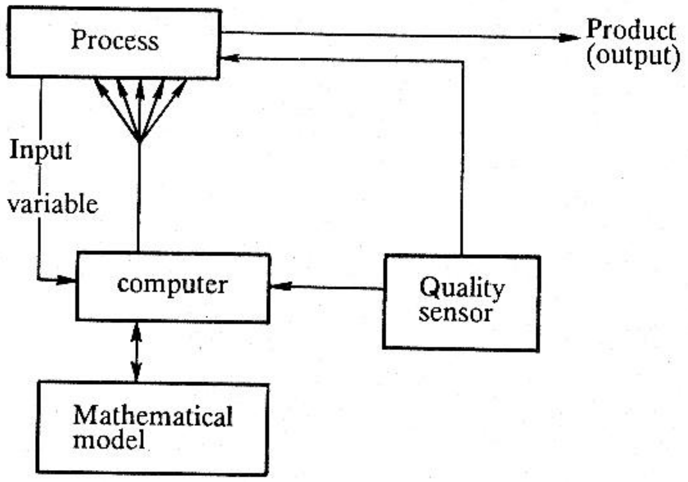
The actual production or process part of a plant may be indoors, outdoors, or a combination of the two. The actual production section of a facility usually has the appearance of a rather industrial environment. Hard hats and work shoes are commonly worn. Floors and stairs are often made of metal grating, and there is practically no decoration. There may also be pollution control or waste treatment facilities or equipment. Sometimes existing plants may be expanded or modified based on changing economics, feedstock, or product needs. As in other production facilities, there may be shipping and receiving, and storage facilities. In addition, there are usually certain other facilities, typically indoors, to support production at the site.

Although some simple sample analysis may be able to be done by operations technicians in the plant area, a chemical plant typically has a laboratory where chemists analyze samples taken from the plant. Such analysis can include chemical analysis or determination of physical properties. Sample analysis can include routine quality control on feedstock coming into the plant, intermediate and final products to ensure quality specifications are met. Non-routine samples may be taken and analyzed for investigating plant process problems also. A larger chemical company often has a research laboratory for developing and testing products and processes where there may be pilot plants, but such a laboratory may be located at a site separate from the production plants.

A plant may also have a workshop or maintenance facility for repairs or keeping maintenance equipment. There is also typically some office space for engineers, management or administration, and perhaps for receiving visitors. The decorum there is commonly more typical of an office environment.

THE ARRANGEMENT OF THE CHEMICAL PLANT

A mathematical model is constructed on the basis of the process know-how and then stored in the computer for basic references. The system includes an optimizing arrangement for quality control; the computer accepts information from the sensors about the quality of the product and then gives instructions to the actuators to change conditions on the plant in order to obtain a better product. The whole system consists of feed forward and negative feedback parts; in the former the computer refers the automatically measured input variables to a mathematical model and takes corrective action if necessary, while in the latter the computer receives data about the quality of the products from the quality sensor and then instructs the actuators to alter variables in the process in order to obtain a product of the desired quality. The complex arrangement is necessary, since no negative feedback can by itself deal with very complex situations, because it is difficult in advanced industrial operations to store all the information required to forecast the quality of products with great accuracy.



Automated control in a chemical plant

PURIFIYING WATER

The methods used to purify water depend on the use to which the water is to be put:

Addition of chemicals, such as chlorine - helps to remove bacteria and other harmful organisms.

Boiling - helps to kill harmful organisms. Addition of chemicals, such as alum - helps to lump together (coagulate) small particles of suspended matter making them heavy enough to settle to the bottom and be removed.

Filtration - Water is permitted to flow through layers of sand and gravel which remove solid matter suspended in the water.

Aeration - Water is sprayed into the air. The sunlight kills some of the bacteria and the oxygen in the air tends to remove unpleasant odours.

Distillation - Water can be freed from dissolved minerals by this process consisting of evaporation followed by condensation of the vapours in a separate vessel. Water is placed in the distilling flask and boiled to convert it into a vapour. The vapour then passes through the inner of two concentric tubes which together make up the condenser.

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

PROCESS CONTROL

In process control, information gathered automatically from various sensors or other devices in the plant is used to control various equipment for running the plant, thereby controlling operation of the plant. Instruments receiving such information signals and sending out control signals to perform this function automatically are process controllers. Previously, pneumatic controls were sometimes used. Electrical controls are now common. A plant often has a control room with displays of parameters such as key temperatures, pressures, fluid flow rates and levels, operating positions of key valves, pumps and other equipment. In addition, operators in the control room can control various aspects of the plant operation, often including overriding automatic control. Process control with a computer represents more modern technology. Based on possible changing feedstock composition, changing products requirements or economics, or other changes in constraints, operating conditions may be re-optimized to maximize profit.

TRANSPORT

Large quantities of fluid feedstock or product may enter or leave a plant by pipeline, railroad tank car, or tanker truck. For example, petroleum commonly comes to a refinery by pipeline. Pipelines can also carry petrochemical feedstock from a refinery to a nearby petrochemical plant. Natural gas is a product which comes all the way from a natural gas processing plant to final consumers by pipeline or tubing. Large quantities of liquid feedstock are typically pumped into process units.

CORROSION AND USE OF NEW MATERIALS

Corrosion in chemical process plants is a big issue that consumes billions of dollars yearly. Electrochemical corrosion of metals is pronounced in chemical process plants due to the presence of acid fumes and other electrolytic interactions. Recently, FRP (Fibre-reinforced plastic) is used as a material of construction. The British standard specification BS4994 is widely used for design and construction of the vessels, tanks, etc.

WHAT IS THE PILOT PLANT?

Do you know the stages a full-scale chemical plant has to pass through before it gets into being? There exist the following periods: research, process development, pilot plant operation, design construction and at last manufacturing itself.

Now let us consider what is meant by pilot plant operation.

Pilot or prototype plants are supposed to be complete medium-scale processing units containing all essential elements, including control.

Pilot-scale equipment is divided into two categories: (1) to produce results applicable to full-scale design or (2) to fulfil a far wider range of operating characteristics than is normally available in producing models.

The conversion of laboratory data from the research group into plant design data is believed to be only one function of the pilot plant. It requires thorough investigation of basic reactions, reactants, time, temperature, concentration and catalysis factors, a study of raw materials, operations needed, control and safety, and health hazards, the pilot plant in such cases being a research unit. It should be used for the selection of suitable equipment and materials, provide time and labour study information, and enable for a study of by-product recovery and waste-disposal problems.

After a new plant or process is designed, the pilot plant continues to eliminate certain troubles.

A check list we suggest below includes all items being considered in the pilot plant investigation: 1. Flow relations; 2. Materials; 3. Equipment of operation; 4. Materials handling; 5. Labour.

The aim is to operate the pilot plant with the assurance that all the risks, both technical and economic, in the full-scale commercial plant have been minimized or eliminated.

The pilot plant has to be capable of operating for long periods under conditions that are not changed frequently, to obtain a fair approximation of labour costs and manufacturing expenses. It should not be dismantled until such times as the full-scale commercial plant starts its successful operation, because it is the place where quality and manufacturing improvements are worked out.

TITANIUM: MODERN TECHNOLOGY'S DESIGNER METAL

W. Gregor in England and M.H. Klaproth in Germany discovered titanium independently in the 1790s. Titanium was named by M.H. Klaproth after the children of Gaia, the earth goddess of Greek mythology. In the initial period, the metal was rare and this was largely because of the fact that isolation from its ores was difficult and there was little demand for the metal.

However, the fact is that it is the seventh most abundant metal found in the earth's crust. It is up to 100 times as plentiful as everyday metals such as copper, zinc and nickel and 400 times more common than lead.

By the middle of the 20th century, titanium became famous and was considered a great discovery among the elements when it was found to have properties that suited ideally to the demands of modern technology. Titanium ores are now mined to the extent of 3 million tonnes each year, while 100 thousand tonnes of the metal itself are produced annually.

Titanium in powdered form is used to produce sparks in many fireworks. It has density that is greater than that of aluminium, but less than those of iron and copper. The lightness when combined with its strength and ability to withstand high temperatures makes it virtually the designer material for the construction of aircraft parts, jet engines and spacecraft.

As technology advances, the demands for this versatile metal of low density, high strength and zero toxicity is sure to multiply.

Урок 10
From Chemical Science to Forensics

I. Предтекстовые упражнения

1. Вспомните, какие модальные глаголы существуют в английском языке (Приложение 1, §18).

2. На примере предложений из текста проанализируйте значения модальных глаголов *can, may, must* и переведите предложения на русский язык:

⇒ The retention time of various components so eluted *can* then be compared to those of known standard molecules eluted using the same method.

⇒ Many different analytical methods *may* be used to reveal what chemical changes occurred during an incident.

⇒ Forensic chemistry is unique among chemical sciences in that its research, practice, and presentation *must* meet the needs of both the scientific and the legal communities.

3. Переведите следующие предложения на английский язык, выбрав правильный модальный глагол (*can, may* или *must*):

⇒ В этом году он закончил университет и теперь *может* работать в нашей лаборатории.

⇒ *Неужели* он работает в нашей лаборатории?

⇒ *Должно быть,* он уже закончил университет и скоро будет работать в нашей лаборатории.

⇒ *Возможно,* что он тоже скоро будет работать в нашей лаборатории.

4. В предложении отсутствуют знаки препинания. Расставьте их и проверьте себя по тексту:

As such forensic chemistry research is applied and derivative by nature and design and it emphasizes metrology and validation.

5. Определите правильное место в предложении для находящегося в скобках слова:

Different substances are "eluted" in differing amounts of time. *(eventually)*

6. Выберите правильное слово:

Forensic chemists usually *perform/reform/inform* their analytical work in a sterile laboratory.

7. Вставьте пропущенное слово:

A small volume of a drug sample or other unknown substance that has been … in an organic solvent is quickly injected into the hot column.

8. Одно из перечисленных слов является антонимом слова *"unknown"*. Назовите это слово:

unknown: foreign, faint, false, familiar, famous, fake.

9. Образуйте синонимичные пары из следующих слов. Одно слово из каждой пары встретится вам в тексте:

solution	research
sample	matter
substance	specimen
investigation	solvent

10. Найдите в словаре перевод следующих однокоренных слов:

⇒ mix, mixable, mixed, mixer, mixture

II. Текст

Запомните следующие слова и словосочетания

applied	derivative	sequence
apply something to something	dissolve	slightly
attach	emphasize	solvent
bind	enforcement	vaporize
coat	forensic chemistry	
coil	reveal	

FORENSIC CHEMISTRY

Forensic chemistry is the application of chemistry to law enforcement or the failure of products or processes. Many different analytical methods may be used to reveal what chemical changes occurred during an incident, and so help reconstruct the sequence of events. Forensic chemistry is unique among chemical sciences in that its research, practice, and presentation must meet the needs of both the scientific and the legal communities. As such, forensic chemistry research is applied and derivative by nature and design, and it emphasizes metrology and validation.

One particularly useful method for the simultaneous separation, identification, and quantitation of one or more individual components of an unknown substance or mixture is the use of a gas chromatograph-mass spectrometer (GC-MS). A GC-MS is actually two instruments that are attached together physically, and together comprising one of the so-called "tandem" or "hyphenated" techniques.

The gas chromatograph (GC) is essentially a hot (150-350°C), temperature-controlled oven holding a bent or coiled, specially packed or coated glass column between one and a few dozen meters long. A small volume (typically a few microliters) of a drug sample or other unknown substance that has been dissolved in an organic solvent (such as chloroform or methanol) is quickly injected into the hot column. Volatile components in the sample are vaporized by the heat of the oven and are forced toward the end of the column by the flow of an inert "carrier gas" (typically helium). The special chemical component(s) within the column bind to substances contained in the moving vaporized sample mixture with slightly different force. As a result, different substances eventually are "eluted" (i.e. emerge from the end of the column) in differing amounts of time, which is known as the "retention time". The retention time of various components so eluted can then be compared to those of known standard molecules eluted using the same method (column length/polarity, flow rate of carrier gas, temperature program). While this comparison provides (presumptive) identification of the presence of a particular compound of interest in the unknown sample, in general the GC portion of the technique is used as a separation and quantitation tool, not an identification tool.

Forensic chemists usually perform their analytical work in a sterile laboratory decreasing the risk of sample contamination.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. What is forensic chemistry?

2. What kind of methods may be used to reveal what chemical changes occurred during an incident?

3. Why is forensic chemistry unique among chemical sciences?

4. Forensic chemistry research emphasizes metrology and validation, doesn't it?

5. What is the gas chromatograph?

6. What kind of components in the sample are vaporized by the heat of the oven?

7. Can the retention time of various components eluted be compared to those of known standard molecules eluted using the same method?

8. The gas chromatograph portion of the technique is used as a separation and quantitation tool, isn't it?

9. Is the gas chromatograph portion of the technique used as an identification tool?

2. Обратите внимание на сочетаемость слова *"substance"* с другими словами для образования различных терминов и дайте русские эквиваленты этих терминов:

$$\left.\begin{array}{r}\text{chemical}\\ \text{heavy}\\ \text{hard}\\ \text{porous}\\ \text{transparent}\\ \text{pure}\\ \text{toxic}\\ \text{foreign}\end{array}\right\}\quad \text{substance}$$

3. Расшифруйте следующие сокращения и переведите их на русский язык. Проверьте себя по ключу (Приложение 6):

сокращение	развёрнутая форма	перевод
med.		
MD		
MSc (= M.Sc.) = MS(=M.S.)		

4. Вспомните, в сочетании с какими существительными встретилось вам прилагательное *“forensic”* в тексте данного урока (2 случая употребления):

forensic	
?	?

Расширьте ваш терминологический словарный запас дополнительными словосочетаниями и определите их значения по словарю:

forensic				
medicine	laboratory	science	scientist	practitioner

IV. Дополнительные тексты для просмотрового чтения с последующим переводом с листа

FORENSIC CHEMISTS

Apply scientific disciplines to physical evidence

A forensic chemist is a professional chemist who analyzes evidence that is brought in from crime scenes and reaches a conclusion based on tests run on that piece of evidence. A forensic chemist's job is to identify and characterize the evidence as part of the larger process of solving a crime. Forensic chemists rarely conduct any investigative work; they handle the evidence collected from the crime scene. Evidence may include hair samples, paint chips, glass fragments, or blood stains. Understanding the evidence requires tools from many disciplines, including chemistry, biology, materials science, and genetics. The prevalence of DNA analysis is making knowledge of genetics increasingly important in this field.

Explain and defend results

Forensic chemists agree that public speaking skills and being comfortable with what you do are important personal characteristics for this career. As seen on Court TV, forensic chemists are often called upon to explain what was found and how they arrived at their conclusions.

Not all cases go to trial, but when one does, giving expert testimony in court is a significant piece of a forensic chemist's job. Some employers require their forensic chemists to go through several months of mock courtroom testimony training along with their regular training. Forensic chemists must be able to give an impartial explanation to the jury that will assist in a final judgment – forensic chemists analyze the evidence but do not determine the verdict.

Have various opportunities

The career path for most forensic chemists is through federal, state, or county labs associated with the medical examiner's office. However, there are different types of careers available, including those in other fields of forensic science, academe, or administration. Chemists can also move up within a particular organization, changing responsibilities along the way. For example, the director of a crime lab may supervise other forensic scientists rather than being involved in day-to-day analysis. A director may also be responsible for case review and general lab management. Some forensic chemists also use their technical training to pursue a career in patent law.

Work Description

Forensic chemists apply knowledge from diverse disciplines such as chemistry, biology, materials science, and genetics to the analysis of evidence found at crime scenes or on/in the bodies of crime suspects. The field is a combination of criminalistics and analytical toxicology. Criminalistics is the qualitative examination of evidence using methods such as microscopy and spot testing, whereas analytical toxicology looks for evidence in body fluids through a range of instrumental techniques from optical methods (UV, infrared, X-ray) to separations analyses (gas chromatography, HPLC, and thin-layer chromatography). Mass spectrometry is also frequently used since it provides the strongest evidence in court. Most often, forensic chemists do not know the nature of the sample before they analyze it. The results of their work are used in police investigations and court trials, at which they may be called upon to provide expert testimony and explain their findings to a jury.

Working Conditions

Forensic chemists generally work in government labs, which can be small, understaffed, and underfunded. They spend time preparing and giving testimony in court. Formerly under the jurisdiction of police departments, forensics has traditionally been totally male dominated. However, over the last 15 years, the field has opened up to women, who are moving up in its ranks.

Places of Employment

Most labs are associated with a federal, state, or local police department, medical examiner's office, forensic services lab, or branch of the Federal Bureau of Investigation. There are some private labs that carry out forensic analyses.

Personal Characteristics

Versatility and patience are the most often cited qualities of a forensic chemist. Forensic chemists must be able to spend hours rigorously applying analytical techniques to evidence and then defending their work in a court of law. They must be able to clearly and concisely answer challenges to their findings. Integrity is also an important characteristic, because it is not unusual for the different interests in a case to try to sway the forensic chemist's position.

Education and Training

A strong background in chemistry and instrumental analysis as well as a good grounding in criminalistics is vital. A forensic science degree at both the undergraduate and graduate level is recommended. Those interested in working with trace evidence, such as glass, hair, and paper, should focus on instrumentation skills and take courses in geology, soil chemistry, and materials science. If forensic biology and DNA analysis are preferred, take microbiology, genetics, and biochemistry courses. Those interested in the toxicological aspects of this work should study physiology, biochemistry, and chemistry.

Job Outlook

The forensic science field is guardedly optimistic about job prospects for the future. Greater interest in the use of DNA analysis is expected to create more jobs. Those interested in DNA work should keep up with the rapidly changing technology and develop skills that distinguish them from the pack.

FROM CHEMICAL SCIENCE TO FORENSICS

Profiles	Forensic science
Name	John Silver
Age	26
Job	Forensic scientist

After taking A Levels in Maths, Physics, Chemistry and Art, I studied for a Chemistry degree at the University of Newcastle upon Tyne. On graduating, I went on to gain an MSc in Forensic Science from the University of Strathclyde. As part of my Masters degree I spent three months conducting research at Florida International University in collaboration with the US Drug Enforcement Administration. Following this, I joined Hayward Associates Consulting Forensic Scientists five years ago as a trainee forensic scientist. After a period of on-the-job training, I started to take on my own casework. I am now a consulting forensic scientist specialising in the examination of footwear marks, glass and alcohol related matters.

Forensic scientists use their scientific knowledge to assist in legal proceedings. After an examination of items submitted to the laboratory, they present their findings to the court in the form of a report or witness statement. Depending on the circumstances of the case, they may be asked to attend court to give evidence in person.

In criminal matters, forensic scientists can undertake work for the prosecution or the defence. At Hayward Associates we undertake work on behalf of the defence.

After three years experience as a court reporting scientist, I was eligible to apply for registration with the Council for the Registration of Forensic Practitioners (CRFP). The CRFP is a professional regulatory body that manages a register of currently competent forensic practitioners.

I enjoy the variety I experience within my working day. One day I may be working on a motoring offence, the next day a murder. Since every case is different, I never stop learning. Although attending court as a witness is often a nerve-wracking experience, it can be very satisfying knowing that you have helped the court to understand a complicated scientific issue.

Other job opportunities related to forensics include: forensic development manager, medical research associate, medical examiner, crime laboratory analyst, crime scene examiner, pathologist, forensic chemist, toxicologist, pharmacologist, analytical chemist, biomedical scientist, clinical biochemist and research scientist.

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

FORENSIC SCIENCE

Forensics is the term given to an investigation of a crime using scientific means. It is also used as the name of the application of scientific knowledge to legal matters. Forensic science has developed over the past 300 years or so, and its processes continue to improve and evolve today as science and technology find better and more accurate techniques. In 1929 the first American forensic lab was created in.

Forensic science covers many areas of traditional science and melds them together to create an area of science called forensics. Forensic science uses areas of science such as:

Chemistry (chromatography, spectroscopic analysis, pH and other chemical tests).

Biology (entomology, fingerprinting, behaviour, hairs, DNA testing, etc.)

Physical science (blood spatter analysis, ballistics, structural analysis, car movements in car accidents). Forensic science is an umbrella term that has various areas under it.

When a crime is committed and the forensic team is called in, there are many experts who cover their specialised fields. Although all these people could be considered forensic scientists, they have specific areas that they work in. There are two main areas of forensic science and these are the minimum requirements for a criminal investigation:

Field officers – these are technicians who visit the scene of a crime and collect the physical evidence that may be related to the crime. They also document and record the scene by taking photographs and videos.

Lab officers – these are technicians who analyse and complete tests on the evidence collected by the field officers.

THE METHODS OF FORENSIC CHEMISTRY

The Mass Spectrometer has become an indispensable tool of many types of chemists and will continue to be important. This piece of equipment is used to identify chemical compounds by breaking them up into smaller charged particles and then detecting them. The first apparatus to be called a mass spectrometer was built by Francis Ashton in Cambridge, UK in 1918.

Using Mass Spectrometer is a Simple Method

Using a mass spectrometer is actually simple, although the practical construction of the equipment is far more complex. First a mass spectrum is produced then it is interpreted. The spectrum is produced by a three stage process.

Ionisation

First the chemical that needs to be analysed must be ionised. This is commonly done by bombarding a small sample of it with high-energy electrons from a heated filament. These electrons collide with the chemical compound and can knock off one of the electrons in the molecule that is under analysis. This produces a positively charged ion. The resulting ion also has some energy that is left over and this can cause a rearrangement within the molecule and further fragmentation. The resulting charged particles of differing size and mass are then ready for the next stage of the process.

Sorting of Fragments

The ions are accelerated by repelling them from a negatively charged plate, through small slits in other electrodes, forming a beam of particles. This beam of particles is then passed between the poles of an electromagnet. This causes the particles to be deflected away from their course. Particles with different masses are deflected by different amounts, so the particles can be sorted according to their masses.

Detection

The final stage is the detection of the particles. This is done by steadily varying the strength of the electromagnet so that a fixed detector measures the relative quantities of particles of different masses. The result is a series of lines on a graph representing the relative abundances of ions of different masses.

Analysis

This spectrum must now be analysed. The line with the highest mass is usually the original molecule, so that the molecular mass of the molecule can be determined from that line. Now detective work must be done by looking at the pattern of other peaks, representing fragments of the original molecule. Different types of compound will give different fragmentation patterns so these can be used to work out possible structures of the original molecule.

Mass spectrometry is often used in organic chemistry to work out the structure of complicated compounds. It is also often used with gas chromatography to analyse mixtures of compounds. The chromatograph separates out the mixture and the mass spectrometer analyses them one at a time.

CHROMATOGRAPHY

Chromatography was first described by the Russian botanist Mikhail Tswet in 1906. Tswet was engaged in the extraction and purification of plant pigments. He extracted the pigments with a solvent calcium carbonate. Various plant pigments were found in definite coloured zones in the tube giving a complete separation. Tswet called this separation a chromatogram and the method itself chromatography. Chromatography is a method of chemical analysis based upon the selective absorption and partial fractionation of various substances by certain suitable materials. A selective developing agent is then passed through the coloumn and the different substances in the solution are spread down the column into layers visibly separated from one another, if the substances are coloured. In the case of colourless substances, the layers may be located by the use of ultra-violet light or by removing the compact column intact and then determining the various layers by chemical tests.

The basic apparatus in column chromatography is the adsorption column. The adsorption column can be constructed of soft glass 'Pyrx' or in special cases of quartz. The diameter and the length of the column depend on the quantity of the material to be adsorbed.

No universal adsorbent has been found. The choice of the adsorbent is determined by the type of separation. A good adsorbent should hold relatively large quantities of materials to be resolved. The resolved materials must be eluted from the adsorbent by polar solvents. The particle size of the adsorbent should be such as to allow rapid and uniform percolation. The adsorbent must not react with either the materials to be resolved or the materials to be used as solvents or colour developers. The adsorbent should not be porous, and, if possible, not coloured.

The substance passed through the column with the object of rapidly and completely liberating the adsorbed compound is known as the eluent. The choice of the eluent depends on the solubility of the adsorbate. In general, substances more polar than the adsorbate perform this task efficiently.

In paper chromatography the adsorption column is replaced with the strips of impregnated paper. The adsorbent is precipitated into the paper. One end of the prepared paper is dipped into distilled water and allowed to stand until the water has climbed one centimeter along the paper. It is then removed and dipped into a solution of the materials to be separated. After the adsorbate has climbed about 2 cm along the strip, the paper is removed from the solution and returned to the distilled water. When the water has climbed to about 12 to 16 cm the strip is removed and dried between filter paper. Brushing the dried paper strip with the proper developer will produce bands similar to those produced in the adsorption column. The strip method requires a minimum of the test solution and several developers may be applied to the same strip.

In 1960 there emerged a new method in chromatography. This is thin layer chromatography (T.L.C.). The technique itself has been described in numerous publications. The main advanteges of the technique over column and paper chromatography are as follows: firstly, the speed of separation and, secondly, the very high degree of resolution which is much superior to that of column or paper chromatography. Thirdly, it involves economy of the adsorbent, solvent and sample, and simplicity of operation. The preparation of the plates and the development of the chromatograms is a simple matter even to comparatively inexperienced operators. Even complex systems can be analysed visually (e.g., by the appearance or disapperance of the components) and simple systems may be assessed semi-quantitatively by comparison with parallel separations of prepared standard mixtures, as is often the practice with paper chromatograms.

Для заметок

Урок 11
Green: the New Colour of Chemistry

I. Предтекстовые упражнения

1. Вспомните, какие модальные слова и фразы существуют в английском языке. (Приложение 1, § 19)

2. На примере предложений из текста определите значение модальных слов (фраз):

Unfortunately, pollution produces numerous adverse effects.

Homo sapiens, *of course,* is a part of the world ecosystem.

3. Замените вышеприведённые модальные слова (фразы) на синонимичные:

unfortunately = ?

of course = ?

4. Вставьте в следующие предложения модальные слова

(фразы) для выражения:

⇒ (уверенности) Every plant or animal of an ecosystem has a definite role to play to maintain an overall balance in the system.

⇒ (предположения) The word «ecology» is on everyone’s lips.

⇒ (подтверждения) A community of plants and animals within a particular habitat is called ecosystem.

⇒ (усиления) Ecology is the study of plants, and animals in relation to their environment.

⇒ (отрицания) Soil and water bacteria can easily degrade numerous new synthetic materials.

5. Определите правильное место в предложении для находящегося в скобках слова:

This role is referred to ecological niche (*as*).

6. Выберите правильное слово:

In *promising/premium/primitive* societies based on hunting and food gathering, homo sapiens fitted in quite well.

7. Вставьте пропущенное слово:

Man-made … frequently alters the environment.

8. Измените следующие слова, увеличив количество букв в слове на одну и найдите эти слова в тексте:

go, and, ever, art, quit, sale, his.

9. В предложении отсутствуют знаки препинания. Расставьте их и проверьте себя по тексту:

According to the definition of a biologist on the other hand ecology is the study of plants and animals in relation to their environment.

10. Найдите в словаре перевод следующих однокоренных слов:

=> ecologic(al), ecologist, ecology.

II. Текст

Запомните следующие слова и словосочетания

accompany	efforts	numerous
adverse	enormous amounts	on a huge scale
community	giant	soil
degrade	habitat	to refer to as
device	maintain	wastes

WHAT IS ECOLOGY?

A few years ago, the average person would not have had the slightest idea of this term. Today, the word is on everyone's lips. The man in the street usually associated it with the effect of pollution and our efforts to clean it up. According to the definition of a biologist, on the other hand, ecology is the study of plants, and animals in relation to their environment. A community of plants and animals within a particular habitat is called ecosystem. Every plant or animal of an ecosystem has a definite role to play to maintain an overall balance in the system.

This role is referred to as ecological niche. Man-made pollution frequently alters the environment in which a community of organisms lives and upsets its delicate balance. Unfortunately, pollution produces numerous adverse effects in addition to disturbing ecosystem.

Homo sapiens, of course, is a part of the world ecosystem. In primitive societies based on hunting and food gathering, he fitted in quite well, he ate roots and berries or trapped animals for food. He began to seriously disturb the balance of nature only after he started to practise farming on a large scale and keep sizeable herds of grass-eating animals.

In recent years, it is the growth of giant cities accompanied by industrial development on a huge scale that has begun to introduce enormous amounts of noxious wastes into the environment. Our transportation devices are likewise serious offenders in this regard as are the numerous new synthetic materials such as plastics that soil and water bacteria cannot degrade.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. Today, the word *ecology* is widespread, isn't it?

2. What is the meaning of the word *ecology*?

3. Is a community of plants and animals within a particular habitat called an ecosystem?

4. Why does every plant or animal of an ecosystem have a definite role to play?

5. Does man-made pollution frequently alter the environment in which a community of organisms lives?

6. Pollution produces numerous adverse effects, doesn't it?

7. Is homo sapiens a part of the world ecosystem?

8. When did homo sapiens begin to seriously disturb the balance of nature?

9. What has begun to introduce enormous amounts of noxious wastes into the environment?

10. Why are transportation devices likewise serious offenders?

2. Обратите внимание на сочетаемость слова *system* с другими словами для образования различных терминов и дайте русские эквиваленты этих терминов:

$$\left.\begin{array}{c}\text{analytic}\\ \text{balanced}\\ \text{code}\\ \text{control}\\ \text{cooling}\\ \text{decimal}\\ \text{emergency}\\ \text{metric}\\ \text{monitoring}\\ \text{optical}\\ \text{solar}\end{array}\right\}\quad \text{system}$$

3. Сокращение *eco*- в сложных словах имеет значение *экологический*. Дайте русские эквиваленты следующих сложных слов и проверьте себя по ключу (Приложение 6).

eco
- -activity
- catastrophe
- cide
- development
- freak
- -fuel
- niche
- politics

4. Вспомните, что означает термин *ecology*. Сформулируйте его определение по-английски и проверьте себя по тексту.

IV. Дополнительные тексты для просмотрового чтения с последующим переводом с листа

OZONE HOLE GROWS BIGGER

The ozone layer is a naturally occurring belt of gases 10 to 30 miles (16 to 48 kilometers) high that makes life on Earth possible by blocking the sun's deadly ultraviolet radiation.

Since the late 1970s about half the ozone layer over Antarctica disappears each September and early October and then returns to normal by late November.

Chlorofluorocarbons, which are used in refrigerators and air conditioners, and halon, which is used in fire extinguishers, are the manufactured chemicals principally to blame for ozone decay. Because of global concern over ozone loss, most nations are trying for phase out their use.

Volcanic eruptions also contribute to the growth of the hole in the ozone layer, scientists said.

Scientists are concerned about continued erosion of the ozone because they say additional ultraviolet radiation reaching Earth may cause tens of millions of additional cases of skin cancer, cataracts and immune-system diseases. Crops, water life and even climate could be affected.

THE SCIENCE OF ICE CORING

Every summer, as the weather changes, the surface ice in the Arctic Ocean and the Antarctic melts a bit. Then in winter, a new layer of ice is added on top. As the ice freezes, it traps dust and air bubbles in the ice, which will remain there almost forever. Over many millions of years, these ice-layers have become many hundreds of metres thick.

Scientists have found that they can figure out the past by drilling 'cores' from these ice-sheets. The bubbles in the core can be analysed (using spectroscopy) to tell us what the air was like all those years ago. Bubbles from the 20th century show more carbon dioxide and CFCs in the air. Bubbles from the last Ice Age (about 18,000 years ago) show very little carbon dioxide.

You can also tell how cold or warm the winter was. Two ways - one, the level of carbon dioxide. Secondly, the thickness of that year's ice itself can tell how cold it had got.

A chemical study of dust in the cores also tells you what was going on that year. For example, ice samples from 1991 show a huge amount of ash. That's the earth's way of remembering a famous volcanic explosion. Because in 1991, Mt. Pinatubo in the Philippines exploded, covering the entire earth with a thin sheet of ash.

Tiny pollen grains are found trapped in the ice cores (pollen can travel incredibly far on tiny wind currents). Many biologists are expert at telling which kind of plants they came from. So for each layer, we know what kinds of plants were growing that year. As the Ice Age receded, there are more pollen grains of tropical plants like bananas and mangoes, and fewer grains of plants like pines, which need cold weather.

GREEN: THE NEW COLOUR OF CHEMISTRY

Every day, millions of tones of hazardous chemicals are buried underground, dumped into rivers, lakes and seas or spewed into the air. The aim of green chemistry is to develop new methods that reduce and prevent pollution.

Paul Anastas and John C. Warner of the U.S. Environmental Protection Agency laid out the Twelve Principles of green chemistry. They are:

1. It is better to prevent waste than to treat it after it is formed.
2. Methods for making new chemicals should be designed so that all the materials used in the reaction become part of the final product.
3. These methods should use and generate substances that possess zero danger to human health and the environment.
4. 'Green' chemical products should work as well as others, and still be less toxic.
5. The use of 'auxiliaries' i.e. substances like solvents, purification agents etc., should be made unnecessary; or harmless substances should be used.
6. 'Green' reactions should minimize the need for conditions like high pressure or low temperature. Instead, they should be possible at normal temperature and pressure.
7. A raw material should be renewable (e.g. like biogas) rather than deplete the natural resource (like coal).
8. A 'green' process should reduce the number of steps, and therefore the need for intermediate products.
9. Reagents that can be, used again and again (called catalytic reagents) should be used instead of those that are needed in large quantities (stoichiometric reagents).
10. A 'green' chemical product should be designed so that when it is not needed, it can break down into harmless chemicals.

11. A 'green' process should allow for monitoring and control in order to prevent the formation of hazardous substances.

12. A 'green' substance or process should not carry a risk for a chemical accident, such as a fire or leak of dangerous substance.

Green chemistry has many challenges ahead of it. To encourage scientists, many countries offer prizes for new technologies that follow these principles.

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

SCIENTISTS LIST 200 KEY WILDLIFE SITES

Two hundred sites where 95 per cent of the world's wildlife could be conserved have been identified by scientists. The sites, which range from river basins and arctic tundra to tropical forests and coral reefs, are to form the backbone of a 30-nation conservation effort headed by the World Wide Fund for Nature.

Under the plan, the charity is to form partnerships with companies, governments and local people to try to preserve habitats. The campaign is also aimed at industries which are causing huge environmental damage.

Industries are being urged to tackle emissions of carbon dioxide, the greenhouse gas, through energy efficiency schemes.

ADVANCES IN GREEN CHEMISTRY

A few technical advancements have been made so far. One of the most important is the use of dry media reactions'. In this, the reagents are embedded in a dry material, rather than dissolved in a solvent. The matrix can be recycled after the reaction is over, thus eliminating what would otherwise have been a huge waste of solvent.

A company called NatureWorks has developed a new packaging material called polylactic acid (PLA) using the above principles. The advantage of PLA is that it is not wasteful to make, and can be recycled. If you forget to recycle it and throw it away instead, it is degraded by bacteria into harmless substances.

MAKE A CONTRIBUTION TO GREEN CHEMISTRY

You too, can make a contribution to green chemistry by taking a small pledge, when you do your chemistry practicals.

1. Reduce Waste: Use as little of the chemicals you need.
2. Increase Safety: Don't pour hazardous substances down the sink, dispose them through the correct methods.
3. Be Efficient: Work out the reaction carefully in your notebook before you do it in the lab.
4. Save Energy: If your reaction needs heating or cooling, do it for the minimum time needed.

If you follow the pledge, you'll not only have a greener experience, but a safer and more scientific one too.

Урок 12
Designing Drugs and Manipulating Molecules

I. Предтекстовые упражнения

1. Объясните, когда и зачем в английском языке используются сокращения (аббревиатуры). (Приложение 1, § 20)

2. На примере сокращений из текста (e.g., i.e., etc., Ph.D., Pharm.D., RPh's, U.S., SAR) объясните разницу между *общепринятыми* и *окказиональными* сокращениями.

3. Обратите внимание на латинские сокращения *e.g.* и *i.e.*, которые читаются сразу в переводе на английский язык:

Написание	Прочтение
e.g.	for example
i.e.	that is

4. В предложении отсутствуют знаки препинания. Расставьте их и проверьте себя по тексту:

Practically speaking it involves chemical aspects of identification and then systematic thorough synthetic alteration of new chemical entities.

5. Определите правильное место в предложении для находящегося в скобках слова:

Scientists in medicinal chemistry are principally industrial scientists. (*work*)

6. Выберите правильное слово:

Medicinal chemistry is by *nature/natural* an interdisciplinary science.

7. Вставьте пропущенное слово:

Medicinal chemistry and pharmaceutical chemistry are disciplines at the … of chemistry and pharmacology.

8. Если в предложении есть ненужные артикли, уберите их. Проверьте себя по тексту:

The pharmaceutical chemistry is focused on *the* quality aspects of *the* medicines and aims to assure *the* fitness for *the* purpose of *the* medicinal products.

9. Найдите в тексте урока слова с противоположными значениями:

to exclude; artificial; resignation; narrow; concealment

10. Найдите в словаре перевод следующих однокоренных слов:

⇒ medical, medically, medicament, medicamentally, medicate, medicated, medication, medicative, medicinal, medicinally.

II. Текст

Запомните следующие слова и словосочетания

alteration	eventually	relationship
background	fitness	research
cellular	guise	specialty
computational chemistry	in particular	target
divide into	include	thorough
encompass	intersection	training regimen
entity	involve	various

PHARMACEUTICAL CHEMISTRY

Pharmaceutical chemistry and medicinal chemistry are disciplines at the intersection of chemistry, especially synthetic organic chemistry, and pharmacology and various other biological specialties, where they are involved with design, chemical synthesis and development for market of pharmaceutical agents, or bio-active molecules (drugs).

Compounds used as medicines are most often organic compounds, which are often divided into the broad classes of small organic molecules (e.g., atorvastatin, fluticasone, clopidogrel) and "biologics" (infliximab, erythropoietin, insulin glargine), the latter of which are most often medicinal preparations of proteins (natural and recombinant antibodies, hormones, etc.). Inorganic and organometallic compounds are also useful as drugs (e.g., lithium and platinum-based agents such as lithium carbonate and cis-platin).

In particular, medicinal chemistry in its most common guise focusing on small organic molecules encompasses synthetic organic chemistry and aspects of natural products and computational chemistry in close combination with chemical biology, enzymology and structural biology, together aiming at the discovery and development of new therapeutic agents. Practically speaking, it involves chemical aspects of identification, and then systematic, thorough synthetic alteration of new chemical entities to make them suitable for therapeutic use. It includes synthetic and computational aspects of the study of existing drugs and agents in development in relation to their bioactivities (biological activities and properties), i.e., understanding their structure-activity relationships (SAR). Pharmaceutical chemistry is focused on quality aspects of medicines and aims to assure fitness for purpose of medicinal products.

Medicinal chemistry is by nature an interdisciplinary science, and practitioners have a strong background in organic chemistry, which must eventually be coupled with a broad understanding of biological concepts related to cellular drug targets. Scientists in medicinal chemistry work are principally industrial scientists.

Most training regimens include a postdoctoral fellowship period of 2 or more years after receiving a Ph.D. in chemistry. Many medicinal chemists, particularly in academia and research, also earn a Pharm.D. Some of these PharmD/PhD researchers are RPh's.

Some entry-level workers in medicinal chemistry, especially in the U.S., do not have formal training in medicinal chemistry but receive the necessary medicinal chemistry and pharmacologic background after employment—at entry into their work in a pharmaceutical company, where the company provides its particular understanding through active involvement in practical synthesis on therapeutic projects.

III. Послетекстовые упражнения

1. Найдите в тексте предложения, отвечающие на следующие вопросы.

1. How can pharmaceutical chemistry and medicinal chemistry be characterized?

2. Compounds used as medicines are most often organic compounds, aren't they?

3. What kind of compounds are useful as drugs?

4. What is medicinal chemistry?

5. Medicinal chemistry involves chemical aspects of identification, and then systematic, thorough synthetic alteration of new chemical entities to make them suitable for therapeutic use, doesn't it?

6. Does medicinal chemistry include synthetic and computational aspects of the study of existing drugs and agents in development in relation to their bioactivities?

7. How is it possible to define bioactivities?

8. What is pharmaceutical chemistry focused on?

9. Is medicinal chemistry by nature an interdisciplinary science?

10. Do many medicinal chemists also earn a Pharm.D?

11. Do some entry-level workers in medicinal chemistry have formal training in medicinal chemistry?

12. When do some entry-level workers in medicinal chemistry receive the necessary medicinal chemistry and pharmacologic background?

2. Обратите внимание на сочетаемость слова *drug* и определите, о каких лекарственных средствах идёт речь:

$$\left.\begin{array}{c}\text{adulterated}\\ \text{investigational}\\ \text{over-the-counter}\\ \text{potent}\\ \text{(non) proprietary}\end{array}\right\}\ \text{drug}$$

3. В тексте данного урока вам встретились несколько сокращений. Вспомните их развёрнутую форму и перевод. Проверьте себя по ключу (Приложение 6).

сокращение	развёрнутая форма	перевод
etc.		
i.e.		
Ph.D.		
Pharm.D		
RPh’s		

4. К каким трём существительным в тексте данного урока прилагательное *pharmaceutical* выступило в функции определения. Проверьте себя по тексту:

pharmaceutical		
?	?	?

IV. Дополнительные тексты для просмотрового чтения с последующим переводом с листа

MEDICINAL CHEMISTRY

Has a History

Medicinal chemistry is the application of chemical research techniques to the synthesis of pharmaceuticals. During the early stages of medicinal chemistry development, scientists were primarily concerned with the isolation of medicinal agents found in plants. Today, scientists in this field are also equally concerned with the creation of new synthetic drug compounds. Medicinal chemistry is almost always geared toward drug discovery and development.

Is Carrying Out Basic Research

Medicinal chemistry research is an important area of research that is performed in many university labs. As an assistant professor at the University of Maryland School of Pharmacy, Alex Mackerell, Jr. has done research on cocaine and cocaine analogs to develop drugs for the treatment of cocaine addiction. His research, however, was not solely focused on just getting a product, but also on understanding basic chemical reactions and their properties. "We were interested in the physical properties and in the underlying mechanisms of cocaine," he says. The purpose of the research was to develop a cocaine antagonist that would cause ill effects when cocaine is ingested. This type of research characterizes the research being conducted in academic environments.

Can Lead To Treatment of Diseases

Grace Smith is using her bachelor's degree in pharmaceutical chemistry for a different kind of drug development. She is a part of a team of analytical chemists at the National Institute of Health (NIH) who formulate drugs that could be used to treat patients with very rare diseases. These formulations are called orphan drugs because they are used to treat diseases found in only small portions of the population. "We try to develop a treatment either from scratch or from research that has already been done in other countries," she says. "My job is challenging because it requires working with several different compounds at one time." Everyday she relies on her knowledge from her undergraduate courses in analytical and organic chemistry. She uses this basic chemistry training when testing and retesting compounds for safety and efficacy, which is the measure of how well a drug product works in the human body.

Is Developing Guidelines

Chemists as the U.S. Food and Drug Administration (FDA) review new drug applications from pharmaceutical companies and are also responsible for reviewing the processes by which the substances are made. These chemists do not work in a laboratory, but their role in medicinal chemistry is important. Charles Kumkumian is the assistant director of the Office of Drug Evaluation for the FDA that, he says, is the largest regulatory group in the world, employing more than 9,000 people. He says that there are about 900 chemists employed in various functions throughout FDA. Ten percent of these are chemists who review new drug applications for entirely new therapeutic entities. An equal number of chemists review additional new drug applications that are generic formulas or over-the-counter dosages.

Links Many Scientific Disciplines

The focus on development of new synthetic drug compounds has resulted in the incorporation of many other disciplines, such as biochemistry and molecular biology, into medicinal chemistry. "Medicinal chemistry involves working in teams with scientists from a variety of other disciplines," says James Kaminski, a senior principal scientist at Schering Plough. "There is a lot of collaboration between chemists and biologists while searching for a lead on a new drug or doing research on a preclinical drug candidate. Then, when you look into the drug safety profile, you work with toxicologists and pharmacologists."

Joel Barrish, group/project leader in pharmaceutical and drug discovery research at Bristol-Company, says that most of his time is spent coordinating the synthetic chemistry efforts of chemists in his group with other members of the project working group outside of chemistry. These areas include biology, computer-aided design, x-ray crystallography, metabolism and pharmacokinetics, legal and regulatory affairs, clinical, franchise management, pharmaceutics, and process research chemistry. Barrish says, "Working in teams is essential to discovering drugs because many different aspects of a molecule must be defined to identify a candidate for clinical studies." He adds, "Medicinal chemistry is the drug discovery engine that provides the tools for the rest of the organization so they can determine the importance of particular biological targets. Kaminski also believes that understanding and interacting with other scientists is key to being successful in this area. Most medicinal chemists find that the opportunity to do research with other scientists while helping to new drugs is an exciting part of their work. Barrish says, "Drug discovery research is a highly creative and stimulating work environment where people are driven to succeed by personal and scientific objectives, and the desire to contribute to society's well-being.

Work Description

Medicinal chemists apply their chemistry training to the process of synthesizing new pharmaceuticals. They also work on improving the process by which other pharmaceuticals are made. Most chemists work with a team of scientists from different disciplines, including biologists, toxicologists, pharmacologists, theoretical chemists, microbiologists, and biopharmacists. Together this team uses sophisticated analytical techniques to synthesize and test new drug products and to develop the most cost-effective and environmentally friendly means of production.

Work Conditions

Medicinal chemistry offers a variety of lab opportunities. Most chemists use their research skills to formulate, produce, and analyze new compounds. However, each lab environment is unique daily activities and career opportunities differ with each one. In academia, chemists explore a compound's different mechanisms in basic research as well as teach at least one full course. In government, laboratory work is not always required, especially at the FDA where they review drug applications. Industry, on other hand, offers chemists a choice of moving into management or staying in the lab.

Places of Employment

Though a wide array of positions exist for chemists in medicinal chemistry, the availability of these jobs is dependent upon the economy, shifting government regulations, and research grants. Employment prospects include the academic environment, pharmaceutical companies, and government. Biotechnology organizations also employ chemists in this area. Industry provides the opportunity to choose between a traditional laboratory career or a nonlaboratory chemistry career in management. Government also offers a choice between a laboratory position and a nonlaboratory chemistry position, such as drug application review.

Personal Characteristics

Medicinal chemists must enjoy varied activities and must be receptive to exploring the unknown. A good imagination and persistence are also two important qualities to have when considering a career in medicinal chemistry. Being a team player with good writing and verbal communication skills are invaluable assets when interacting with scientists from other disciplines.

Education and Training

Generally, pharmaceutical companies hire only people with research experience, advanced degrees especially in organic chemistry, and at least two years of post-doctoral experience. Most chemists in traditional research careers are Ph.D. chemists while chemists with B.S. degrees generally serve as research technicians. You can place yourself in a competitive position by getting as much experience as possible with a strong background in organic chemistry and biochemistry. A number of universities have formed medicinal chemistry programs in the past 20 years.

FROM CHEMICAL SCIENCE TO INDUSTRY

Profiles	Medicinal chemistry
Name	Mary Brown
Age	29
Job	Senior research chemist

Having studied Chemistry, Physics, Mathematics and General Studies at A Level, I continued my education at Loughborough University with a degree in Medicinal and Pharmaceutical Chemistry.

After graduating, I began work at AstraZeneca in their medicinal chemistry department as a Research Scientist. I had to show that I was competent and productive in the laboratory environment. My communication and team-building skills developed, and my problem-solving skills improved enormously through reading literature and discussion with colleagues. These skills enabled me to be promoted to senior research chemist after just 3 years.

As a senior research chemist in the medicinal chemistry department, my job is to design and synthesise novel chemical compounds targeted to treat a variety of human diseases. These chemicals may have the potential, in the future, to become drugs that doctors can prescribe to patients. To do this successfully involves working with a wide range of specialists including biologists, molecular modelers, chemical engineers, safety consultants and patent attorneys.

I spend the majority of my time in the lab doing hands-on practical synthetic chemistry, which involves carrying out a variety of chemical reactions. Once the reaction has been completed the chemical product must be purified to as high a standard as possible. A variety of analytical techniques are then used to confirm the correct chemical has been synthesized.

I like being at the beginning of the drug discovery process and knowing that a new chemical I have synthesized in the laboratory might, one day, become a new medicine. My job is different every day, and I am able to experiment with new ideas, using knowledge I have gained from reading about other research to make chemicals that have never been synthesised before.

Skills such as time management and problem solving are essential, as is the ability to communicate effectively with other people (including those without a chemistry background). Computer literacy is important as computers are used to simulate molecules and to analyse data.

A Chemistry degree is essential to work in medicinal chemistry because this allows you, through the knowledge you have gained while studying, to make an informed decision on how to synthesise a target chemical.

PAUL EHRLICH'S MAGIC BULLET THEORY

Just a hundred years ago, drugs were expensive and had to be obtained from exotic tropical trees. This changed with the discovery of an artificial compound called Salvarsan. It cured the dreaded disease syphilis and laid the foundation of modern medicine.

The beginning of organic chemistry

Organic compounds like urea, which was earlier obtained from kidneys, are complex in nature. For a long time, they could not be created in the laboratory. The first breakthrough came in 1828 when Friedrich Wohler succeeded in synthesizing urea artificially. In the following decades millions of new compounds were synthesized.

The potential of these compounds to treat diseases was never taken seriously. This was because many of these compounds are highly toxic and caused side effects. For example, atoxyl (arsanilic acid), was effective against trypanosomes, the bacteria that cause sleeping sickness. But atoxyl also caused blindness.

Salvarsan: The first big success

Paul Ehrlich was a German chemist interested in the science of chemotherapy. In 1906, he deduced the chemical structure of atoxyl. From there he made the most vital conceptual breakthrough - Make a large number of modifications from the basic compound, and test each for its ability to cure infected mice. Something would ultimately be found which was very effective, yet relatively safe for humans. He called it the 'magic bullet' theory, for which he got the Nobel Prize in 1908.

In 1909, he and his team discovered salvarsan, which was deadly against bacteria that caused syphilis, but was yet relatively safe for human use. Very quickly, salvarsan became the most prescribed drug in the world.

V. Контрольный перевод

Переведите тексты в письменной форме. Сравните с другими переводами студентов группы. Выберите лучшие варианты.

WHY WE NEED NEW DRUGS

Well, there are many reasons. One reason is that medicines are not a natural part of our body. We know how they go right, like we know penicillin kills bacteria, or paracetamol reduces fever. But we've got to accept that they don't work perfectly, yet.

That does not mean all medicines are unsafe. For example, tamiflu prevents viruses from escaping infected cells, so they cannot infect new cells. But if you've not eaten properly or took some other medicine, a tablet of Tamiflu might give you a mild stomach-ache. Taken properly, most drugs have no bad effects.

A MORE PERFECT DRUG

Why are drugs not perfect? It's because of chemistry.

Most of the molecules in our body are proteins, which do things like digesting food and taking oxygen to all cells of the body. Every medicine has its correct target protein. For example, tamiflu blocks the action of a protein, which is made by the flu virus. There is a spot on the protein which is important for the virus to work. Tamiflu goes and sits exactly in that spot, stopping the protein dead in its tracks. However, it doesn't sit very tightly, and in time gets knocked off. So you have to give more Tamiflu after some time to keep the protein under control.

FROM EARLY DISCOVERY TO MASS PRODUCTION

In 1928 Scottish scientist Alexander Fleming discovered Penicillin.

Pencillin was one of the first antibiotics that proved to be effective against a variety of diseases.

Though Fleming discovered Penicillin, he was unable to produce it in a large scale. He also noticed that it was difficult to isolate the exact antibiotic agent. His researches led Fleming to believe that the Penicillin bacteria did not last long enough inside the body. Fleming's research was carried forward by Howard Florey and Ernst Boris Chain. The duo was able to mass produce the drug after the bombing of Pearl Harbour during the Second World War. However it would only be in 1945 with Norman Heatley's experiments that Penicillin as a drug was mass distributed.

SPIDER SILK

Also known as gossamer, spider silk is known to be stronger than steel (of matching thickness), while being extremely light. It has many potential uses, from use in bullet-proof jackets to wound dressings. The problem is a means to produce it commercially hasn't been found yet. Thanks to genetic engineering attempts are now being made to produce it in the milk of genetically-modified goats.

LOTUS EFFECT

Lotus leaves are completely waterproof. Nothing ever sticks to them. That's because the surface of the leaf contains microscopic hairs coated with wax, that doesn't offer space for anything to stick, causing water droplets to roll off. This means the leaf is self-cleaning! The principle has been used to create non-stick paints, using nanotechnology to mimic the lotus leafs microscopic surface.

COURSE OVERVIEW OF PHARMACEUTICAL CHEMISTRY IN BRITISH UNIVERSITY

This degree provides you with a sound general grounding in chemistry but focuses on, and extends into, topics of relevance to the design and production of new medicinal compounds and understanding their biological actions.

The Freshman years

In the first two years you will follow the Science programme, taking chemistry, biology and mathematics in the Junior Freshman (first) year. In the Senior Freshman (second) year you will take chemistry and 20 prescribed units of biology with the option of further biology (20 units) or mathematics (20 units). In addition, special sessions held specifically for your group will introduce you to the ideas and techniques of medicinal chemistry.

The Sophister years

In the Junior and Senior Sophister (third and fourth) years the course will branch off into the more specialised aspects of medicinal chemistry, although there will be considerable overlap with the Chemistry programme.

The overlap will be mainly in organic chemistry, with less emphasis being placed on physical chemistry and inorganic chemistry in order to allow for the introduction of the new medicinal chemistry units.

In the Junior Sophister (third) year, your special medicinal chemistry courses will include:

- Basic principles of medicinal chemistry

- Pharmacology (how drugs interact with the body)
- Drug design (how chemists design new drugs for specific diseases)
- Anti-viral and anti-cancer agents
- Anti-microbial and anti-infective agents (compounds that can combat the microorganisms that cause disease)
- Anti-malarial chemistry (study of the development of new drugs in this area)
- Steroid drugs (study of drugs based on the steroid skeleton)
- Industrial chemistry (short course on medicinal chemistry in industry)

In the Senior Sophister (fourth) year, you will cover the medicinal chemistry of the cardiovascular and central nervous systems, combinational chemistry and drug delivery, as well as computational medicinal chemistry and modern analytical methods. Case studies in medicinal chemistry (focusing on specific diseases or drug types), will also feature on your programme.

Practical work in the final year will consist of a research project. This may be carried out either in the College under the supervision of a member of staff, in a chemistry department at an overseas university, or in a commercial laboratory.

Обзорный урок

I. Повторение грамматики (Приложение 1, §§ 1-20)

1. Раскройте скобку и поставьте глагол-сказуемое во все времена действительного и страдательного залога. (Приложение 1, §§ 1, 8):

He (to make) a scientific report.

2. Раскройте скобку и поставьте глагол-сказуемое в правильной временной форме (Приложение 1, §§ 2, 3, 4):

⇒ He (to make) scientific reports every month. (делает)

⇒ He (to make) his scientific report last week. (сделал)

⇒ He (to make) his scientific report now. (делает)

⇒ He (to make) his scientific report already. (сделал)

⇒ He (to make) his scientific report for two hours. (делает)

⇒ He (to make) his scientific report by Friday. (сделает)

⇒ He (to make) his scientific report from 2 to 3 o'clock. (делал)

⇒ He (to make) his scientific report tomorrow. (будет делать)

3. Раскройте скобку и поставьте глагол-сказуемое в нужной форме с учётом правила согласования времен. (Приложение 1, §§ 5, 6):

⇒ I knew that he (to make) his scientific report soon.

⇒ He said that he (to make) his scientific report when I rang him up.

⇒ He said that he (to make) his scientific report the day before.

4. Проанализируйте, какой тип условия представлен в следующем предложении и переведите это предложение на русский язык (Приложение 1, § 7):

If he had taken part in the conference, he would have made a scientific report there.

5. Объясните, какие грамматические правила следует учесть при переводе следующего предложения на английский язык. (Приложение 1, §§ 7, 8, 10):

Его пригласят на конференцию при условии, если он согласится сделать там доклад.

6. Определите функции инфинитива в следующих предложениях. (Приложение 1, § 12):

⇒ He wants to make a report.

⇒ It must be interesting to make a report.

⇒ He is always ready to make a report.

⇒ He was the first to make a report.

⇒ He has come here to make a report.

⇒ He is too busy to make a report.

7. *Переведите следующие предложения на английский язык, используя инфинитивные комплексы. (Приложение 1, §§ 15, 16, 17):*

⇒ Он обязательно выступит с докладом на этой конференции. (комплекс «Именительный падеж с инфинитивом»)

⇒ Пусть он выступит с докладом на этой конференции. (комплекс «Объектный падеж с инфинитивом»)

⇒ На этой конференции ему необходимо выступить с докладом. (комплекс с предлогом for)

8. *Определите значение модальных глаголов в следующих предложениях (Приложение 1, § 18) и переведите предложения на русский язык:*

⇒ He said that he could make a report.

⇒ Could he have made a scientific report?

⇒ He may make a report at the forthcoming conference.

⇒ He may not have made his report yet.

⇒ He must make his report tomorrow.

⇒ He must have refused to make a report.

9. *С помощью каких модальных слов или фраз выражено отношение говорящего к высказыванию в следующих предложениях? (Приложение* 1, § 19):

⇒ No doubt he will make a report at this conference.

⇒ Will he make a report at this conference? – Most certainly.

⇒ I really don't know whether he will make a report at this conference.

⇒ Unfortunately he couldn't make a report at this conference.

⇒ Of course you understand that it's necessary to make a report at this conference.

10. *Переведите следующее предложение на английский язык двумя способами: с помощью модального глагола (Приложение 1, § 18) и с помощью модального слова. (Приложение 1, § 19)*

Возможно, на этой конференции он выступит с докладом.

II. Повторение терминологической лексики

Дайте русские эквиваленты терминов, встретившихся вам в уроках 1–12:

⇒ molecule, matter, property, composition, to provide;

⇒ background, pharmaceutical, fitness, include, involve, specialty, adulterated, investigational, over-the-counter, potent;

⇒ arrange, attempt, criticize, exhibit, identify, pattern, predict, recognize, valence;

⇒ accumulate, precautions, substance, unavoidable hazard, test something, poison, tubes, test-tubes, evaporating, funnels, weighing bottles, beakers, flasks, bulbs, stoppers, bottles, pipettes;

⇒ observation, explanation, information, pollution, researcher, discovery, to suggest, hypothesis;

⇒ capacity, costs, efficient, manufacture, oil refinery, petrochemical, pollute, process, profit, remove;

⇒ to emit, hypothetical, disaster, to consider, to prevent, evidence;

⇒ solution, sample, solvent, specimen, bind, coat, dissolve, forensic chemistry, slightly, vaporize, chemical, heavy, hard, porous, transparent, pure, toxic, foreign;

⇒ ecology, community, efforts, numerous, soil, wastes;

⇒ acknowledge, award, found, resign, thorough, conversion, integral, multiplication, mortality, numerical;

⇒ to define, measurement, to deal with, to determine, man-made;

⇒ usage, machine, procedure, to improve, to refer to, consequence, advanced technology, to fulfill, requirement, to satisfy requirements, raw material, conductor.

III. Повторение выборочного текстового материала

Переведите с листа фрагменты текстов (уроки 1–12) без предварительной подготовки:

1. What is chemistry

Chemistry is the study and manipulation of molecules or matter, its structure, properties, and composition, and the changes that matter undergoes. Chemists routinely create new matter that finds applications in computing, nanotechnology, biotechnology, drug discovery, biology and medicine.

Chemistry provides an important part of the solution to needs in society and can provide opportunities and the knowledge for economic development. There is a need for the broadly educated chemist who can work on the core topics as well as those who can work and communicate with biologists, physicists, clinicians and engineers.

2. Science and scientific methods

Scientists search for facts about the world around them. They try to find logical explanations for what they observe.

Pure science is the search for a better understanding of our physical and natural world for its own sake. Pure scientists are not concerned with finding uses for their discoveries. Pure scientists get satisfaction from simply knowing why things are as they are and why they happen as they do.

Applied science, or technology, is the practical application of scientific discoveries. Applied scientists put scientific discoveries to work. The technology produced by applied scientists has made possible the current state of our civilization. As a result of technology, many people today have easier lives and live longer.

3. Discoveries of the past

We shall define inorganic chemistry today as the study of formation, composition.

Two facts helped the development of inorganic chemistry: the growth of the theoretical techniques of quantum mechanics and new optical, electrical and magnetic techniques of physical measurement by which structure can be investigated.

People say that facts give a science its substance, but it is the theory which provides its strengths. It is owing to the development of the theory that inorganic chemistry has before it such exciting prospects at the same time.

4. Will the human race survive the twenty first century?

Steam engines, nuclear war, the population explosion, chemicals, social dislocation and genetically modified food have come and gone without leaving us worse off: in fact, the more technology we invent, the healthier, wealthier and wiser we become.

There is undoubtedly a risk in innovation but there is also a risk in a lack of innovation, and stopping all invention at any point in our previous history would have resulted in humanitarian and ecological catastrophes on a vast scale.

The greatest risk of all is the risk of doing nothing.

5. Technology

Technology is the making, modification, usage, and knowledge of tools, machines, techniques, crafts, systems, methods of organization, in order to solve a problem, improve a preexisting solution to a problem, achieve a goal, handle an applied input/output relation or perform a specific function. It can also refer to the collection of such tools, machinery, modifications, arrangements and procedures. Technologies significantly affect human as well as other animal species ability to control and adapt to their natural environments.

6. Laboratory

A laboratory is a facility that provides controlled conditions in which scientific research, experiments, and measurement may be performed. Scientific laboratories can be found in schools and universities, in industry, in government or military facilities, and even aboard ships and spacecraft. A laboratory might offer work space for just one to more than thirty researchers depending on its size and purpose.

Labs used for scientific research take many forms because of the differing requirements of specialists in the various fields of science.

7. The periodic table

There are many ways the Periodic Table can be used. The table can be used to find the atomic number. The atomic weight is also indicated in the table. The orbital arrangement of electrons is shown for each of the elements. The common oxidation states are given. For most elements these numbers are the same as the valence numbers.

The table enables us to recognize families of elements. And at last the table can be used to predict the properties of the elements. The fact that the Periodic Table can assist in predicting properties of elements has helped in the discovery of missing elements.

8. Dmitri Mendeleev

Dmitri Ivanovich Mendeleev was a Russian chemist and inventor. He created the first version of the periodic table of elements. Using the table, he predicted the properties of elements yet to be discovered.

Mendeleev was one of the founders, in 1869, of the Russian Chemical Society. He transformed Saint Petersburg into an internationally recognized center for chemistry research.

Mendeleev worked on the theory and practice of protectionist trade and on agriculture. Also he is given credit for the introduction of the metric system to the Russian Empire.

9. Chemical plant

A chemical plant is an industrial process plant that manufactures (or otherwise processes) chemicals, usually on a large scale. The general objective of a chemical plant is to create new material wealth via the chemical or biological transformation and/or separation of materials.

Chemical plants typically use chemical processes, which are detailed industrial-scale methods, to produce the chemicals. The same chemical process can be used at more than one chemical plant, with possibly differently scaled capacities at each plant.

Chemical processes may be run in continuous or batch operation.

10. Forensic chemistry

Forensic chemistry is the application of chemistry to law enforcement or the failure of products or processes. Many different analytical methods may be used to reveal what chemical changes occurred during an incident, and so help reconstruct the sequence of events. Forensic chemistry is unique among chemical sciences in that its research, practice, and presentation must meet the needs of both the scientific and the legal communities.

Forensic chemists usually perform their analytical work in a sterile laboratory decreasing the risk of sample contamination.

11. What is ecology?

A few years ago, the average person would not have had the slightest idea of this term. Today, the word is on everyone's lips. The man in the street usually associated it with the effect of pollution and our efforts to clean it up. According to the definition of a biologist, on the other hand, ecology is the study of plants, and animals in relation to their environment. A community of plants and animals within a particular habitat is called ecosystem. Every plant or animal of an ecosystem has a definite role to play to maintain an overall balance in the system.

Homo sapiens, of course, is a part of the world ecosystem.

12. Pharmaceutical chemistry

Pharmaceutical chemistry and medicinal chemistry are disciplines at the intersection of chemistry, especially synthetic organic chemistry, and pharmacology and various other biological specialties, where they are involved with design, chemical synthesis and development for market of pharmaceutical agents, or bio-active molecules (drugs).

Medicinal chemistry

Encompasses synthetic organic chemistry and aspects of natural products and computational chemistry in close combination with chemical biology, enzymology and structural biology, together aiming at the discovery and development of new therapeutic agents.

Pharmaceutical chemistry is focused on quality aspects of medicines and aims to assure fitness for purpose of medicinal products.

Аннотирование
и
реферирование

Аннотирование и реферирование

Сущность аннотирования и реферирования заключается в максимальном сокращении объема источника информации при существенном сохранении его основного содержания.

Аннотирование и реферирование – это сложный мыслительный процесс, требующий от референта не только хорошего владения иностранным языком, но и специальных умений проводить компрессию материала: кратко сформулировать свои мысли, выделить главное, отсеивать второстепенное. Однако, аннотирование и реферирование осуществляют компрессию первоисточника принципиально различными способами. Аннотация дает самое общее представление о первоисточнике и *не может заменить* его. Реферат сообщает все существенное содержание материала и *вполне может заменить* первоисточник.

Аннотация

Аннотация – это предельно сжатая характеристика материала, не раскрывающая его содержания и не отражающая точку зрения автора. Аннотация лишь перечисляет те положения, которые представлены в первоисточнике, информируя, таким образом, о наличии работы по данной проблематике. Из аннотации можно получить ответ на вопрос: «О чем говорится в первоисточнике?»

Различают два типа аннотаций:

- описательная аннотация
- реферативная аннотация

Описательная аннотация лишь перечисляет вопросы содержания первоисточника.

Реферативная аннотация, кроме этого, в предельно сжатом виде передает выводы по каждому из вопросов и по материалу в целом.

Средний объем аннотации составляет 600 печатных знаков или 50-70 слов.

Реферат

Реферат – это ограниченное малым объемом и вместе с тем наиболее полное изложение основного содержания первоисточника. Реферат предполагает критическое осмысление всего материала первоисточника. Составитель реферата может давать свою оценку позиции автора, сопоставлять различные точки зрения. Таким образом, передавая то, что непосредственно содержится в первоисточнике, то есть отвечая на вопрос «Какая информация содержится в источнике?», реферат одновременно представляет собой новый самостоятельный материал.

В сфере научной деятельности, реферат является одним из самых распространенных жанров письменного сообщения. Объем реферата может быть различным и определяется содержанием первоисточника, количеством сведений и их научной ценностью. Средний объем текста реферата в печатных знаках:

500 – для заметок и кратких сообщений;

1000 – для статей среднего объема;

2500 – для материалов большого объема.

1. Составьте описательные аннотации к следующим статьям:

Rare Earth Minerals

Praseodymium and dysprosium join 15 other elements in a group called 'rare earth minerals'. They are actually not rare. They are quite widely spread out on the earth's crust. Here's a picture of the periodic table with the rare earths marked:

Rare Earths All Around Us

Rare earths are widely used in making electronic devices, like your computers and laptops, mobile phones, digital cameras and portable music players.

Let's look inside a digital camera. The lens is made from a special glass that has lanthanum or lutetium in it, so that the images have no distortion. The electronic circuit board has many tiny magnets in it, made from neodymium, samarium and many other rare earths. Europium and terbium are what help make the display look so colourful. All of these elements, in just one device!

Combinations of rare earth oxides are also used to make high temperature superconductors, which are used in MRI and maglev trains. And new uses are being discovered every day.

Rare Earth Diplomacy

Few of us can imagine going out today without our mobiles and music players. We can't imagine a house without an LCD TV or an office without laptops. In the future, we'll have even more electronic gadgets. That means we need more supplies of rare earths.

However, concentrated ores of these minerals are quite rare. They are often found with thorium, a radioactive element. Because of this, mining and refining these elements is both expensive and dangerous.

Today, 97% of all rare earths are mined in China, from the Gobi desert.

This makes countries which have many electronics industries - like Japan, India, Taiwan and South Korea - dependent on imports from China. In recent times, as China develops its own electronics industry, the availability of these minerals to other countries has been reduced.

Today a worldwide search is on for sources of rare earths outside China. India, Brazil, Canada and Australia have reserves, from which thousands of tons can be mined.

Molecular Robots

Now few of us suffer much from infectious diseases like malaria or typhoid, and many of us live longer lives. But with age come new kinds of illness like Alzheimer's. Completely new kinds of medicines are needed to treat such illnesses.

Genetic disorders

Sometimes we fall ill because something is wrong in our genes. A gene is simply a fragment of DNA that encodes information on how to make a protein. This information is copied from old DNA to new one by an enzyme known as DNA Polymerase. But sometimes, the enzyme makes errors, just like we make spelling errors when copying a passage from a book.

Spelling errors in DNA can be serious. The machine that reads the information in each cell of our body (called a ribosome) cannot guess that these are errors. Because of this, it will make the protein wrongly. And a wrongly made protein can be very dangerous.

In a disease like Alzheimer's or Parkinson's, the wrongly made protein cannot do its work correctly. Instead, the protein molecules lump together, and prevent the cell from doing its natural job. If these lumps become very large, they can be seen through a microscope or through CT scans. These lumps (called plaques) often form in the brain, leading to forgetfulness, shivering of arms, and finally lead to dementia.

The patient can be helped if we could find a way to break up these plaques. That's where DNA robots can perform Gene Surgery.

DNA exists as a double helix in our body, but single strands of DNA can have very interesting shapes. This shape is decided by the sequence of the DNA. DNA of certain shapes can function like enzymes themselves, and carry out chemical reactions inside the cell. These reactions include correcting wrongly spelt DNA.

So if one can make the DNA with the right sequence, it will get the right shape. Then you can use it to correct the spelling errors in the genetic code. This in turn means that the cell will make the right type of protein, which will not form plaques. Molecular robots can also be designed to break up existing plaques.

Molecular robots are still a long way away from daily life, but scientists have made much progress. Now they've even begun to figure out ways to program these robots, so that they will do exactly the task they are meant to, without any side-effects. So if you plan to go into biotechnology, you might find making and programming these robots an exciting career challenge!

Some doctors have tried gene therapy before by introducing the correct version of a gene into a cell. But it has many problems, since getting the correct gene into every cell is still a challenge. Even then, the wrong gene will still be making the wrong protein. Using a molecular robot can overcome this problem, since the robot can correct the original gene that was wrong.

Meet the New Plastics

Things made of plastic, from credit cards to spoons to bags, have become so common in our lives that we can hardly think of life without them. Yet all plastics are made from petroleum, which will run out in a few decades. What do we do next?

How plastics are made

All plastics are polymers, that is they are made of a molecule which is itself made of hundreds of small molecules. These units are called monomers. Polyethylene (used in plastic bags) is made from a monomer unit called ethylene. Similarly styrofoam (used in disposable cups and plates) is made from a unit called styrene. PVC, which is used to make things like buckets and even plastic doors, is made from units of vinyl chloride linked to each other by chemical bonds.

All these units ultimately come from petroleum. But the reserves of petroleum are quite rare, and will run out in our lifetime. Most of the petroleum extracted from under the ground and the sea is used to make petrol and diesel for fuel. So we need to look for other sources of monomers.

Plastics are non-biodegradable, that is bacteria cannot break them down into simpler chemicals, unlike vegetable peels or paper. Read more about the harmful effects of plastic bags here.

Plastic from potatoes

Potatoes contain a lot of starch (cellulose), which can be used to make a plastic-like material quite easily and cheaply. This plastic is not very strong or long-lasting. It is also very easily broken down by bacteria (see an article about eco-friendly plastic here). But that makes it the ideal material for making disposable spoons, cups, plates etc. In fact many companies have already begun to do so, and they have given it a nice name too - Spudware!

Plastic from chicken feathers and soybeans

The circuit board you see on electronic devices is made of a light but durable plastic, on which tiny electronic circuits are soldered on. Mingjiang Zhan and Richard Wool of the University of Delaware do research on ways to make these boards from common materials. They found that a material derived from chicken feathers and soybeans does as well as plastic ones, and is much cheaper. As computers, mobile phones and other electronic gadgets spread through the world, we'll need millions of these feather-bean boards!

Orangeware

A team from Cornell University found another way to make plastic. They used orange peels, and another material that is becoming increasingly common in our atmosphere - carbon dioxide. Orange peels contain a chemical called limonene (the same thing that gives the orangey smell). The team found that you can convert it to limonene carbonate, which could then be polymerised into a useful plastic called poly-limonene carbonate (PLC). This is in fact a de-polluting plastic, because to make it you need to remove CO_2 from the air, rather than add to it.

We hope that you'll be inspired to make something equally clever from materials lying around the house too!

Does Distilled Water Conduct Electricity?

Most of us are familiar that wires and metals conduct electricity. However, did you know that water too can help electricity travel? But not every water conducts electricity and the rate of electricity conduction is also different. Wondering how? Let us explain...

What Is Distilled Water?

Plain water contains dissolved minerals like calcium, magnesium, iron and sodium. When water is boiled and the steam is allowed to condense in a reservoir, the pure liquid that remains, devoid of minerals, is called distilled water.

What Is Electricity?

Understanding how electricity travels will help answer the question "Does distilled water conduct electricity?”. But first, we need to start with understanding 'atoms'. When an atom has more protons than electrons, it has a positive charge. When the atom has more electrons than protons, it has a negative charge. Atoms prefer to have a neutral charge and will swap electrons to become neutral. As electrons are passed from one atom to another, a flow of electricity is created.

Since distilled water is purified and does not contain any impurities, it is unable to conduct electricity. Water molecules on their own have no charge and as a result they cannot swap electrons. Without the swapping of electrons, electricity is unable to travel through distilled water.

Salt water, on the other hand, is considered a good conductor of electricity because it contains ions in it. Tap water, although it doesn't taste salty, can also conduct electricity because it isn't pure. The water from the kitchen sink often has traces of minerals such as calcium, Ca^{2+}, and magnesium, Mg^{2+} and can help conduct electricity.

Why is Sulfuric Acid Called the King of Chemicals?

What's common to petrol, fertilizers, cars and soaps? They, like a lot of other things, require sulfuric acid to be made. That's why sulfuric acid is called the king of chemicals.

The uses of sulfuric acid

Sulfuric acid is involved, in some way or the other, in the manufacture of practically everything. Indeed, the production of sulfuric acid is sometimes used as a measure of how industrially advanced a country is. India produces about 48 Lakh tonnes of this acid a year.

60% of all sulfuric acid produced is mixed with crushed phosphate rock to make phosphoric acid. Phosphoric acid has two uses - to make phosphate fertilizers, and to make sodium triphosphate, which is a detergent.

Lots of sulfuric acid is used to clean up rust from steel rolls. These cleaned up rolls are used to make cars, trucks, as well as household appliances. Sulfuric acid is used in petroleum refining to make high-octane petrol, which burns efficiently. It is put in the lead-acid batteries of your car battery. It is used to make aluminium sulfate, which is needed for making paper. It is used to make ammonium sulfate, a common fertilizer. It is used to make ... well, it is used to make practically everything!

On earth, sulfuric acid does not exist in a natural form. But on the planet Venus, there's plenty of it. There are lakes of the acid, which evaporate to form clouds, which then rain sulfuric acid upon the Venerean surface. The USSR's Venera-3 spacecraft landed on Venus on March 1, 1966 and was digested in minutes!

Handling sulfuric acid

Never handle sulfuric acid yourself. If you spill a drop on your hand, it will react with the tissue, burning it instantly. It also causes dehydration. Fumes of sulfuric acid can cause blindness, and damage the lungs if inhaled. In case you accidentally spill acid on yourself, wash it under a tap for fifteen minutes at least, so that even the tiniest drop is washed away.

Even dilute sulfuric acid is dangerous. When handling sulfuric acid, always wear thick gloves and a lab coat or apron. Never handle it on an open bench, but use it in a fume hood. Never pour it from the bottle, but always use a thick glass pipette with a rubber bulb. The best is to let your teacher handle it, while you stand aside and watch.

Sulfuric acid is often stored in concentrated form. When diluting it, never pour water into the acid. That will make the whole thing explode. Instead keep crushed ice (made from pure water) in a large beaker, and pour the acid onto it, drop by drop. The ice absorbs the heat of the reaction, so it won't explode. When the ice melts, you get dilute sulfuric acid.

II. Составьте реферативные аннотации к следующим текстам:

Discovery of Titanium

W. Gregor in England and M.H. Klaproth in Germany discovered titanium independently in the 1790s. Titanium was named by M.H. Klaproth after the children of Gaia, the earth goddess of Greek mythology. In the initial period, the metal was rare and this was largely because of the fact that isolation from its ores was difficult and there was little demand for the metal.

However, the fact is that it is the seventh most abundant metal found in the earth's crust. It is up to 100 times as plentiful as everyday metals such as copper, zinc and nickel and 400 times more common than lead.

By the middle of the 20th century, titanium became famous and was considered a great discovery among the elements when it was found to have properties that suited ideally to the demands of modern technology. Titanium ores are now mined to the extent of 3 million tonnes each year, while 100 thousand tonnes of the metal itself are produced annually.

Titanium Oxide, the Whitest Substance Known

Small concentrations of titanium are widespread in rocks, and it is a common contaminant of ores of iron. The powdered oxide that is formed by purification of rutile, which is the principal ore, is the whitest material known, and is the standard against which other white substances are compared.

Till now, the main pigment in white paint was lead carbonate. However, this is poisonous and tends to darken with age because of the reaction with sulphur compounds from burning fuels. The extreme whiteness of titanium oxide combined with its lack of toxicity meant that this compound has now almost completely replaced white lead in paints.

Use in Architecture

Titanium is one metal that also finds a use in architecture. In architecture it provides the outer shell of certain buildings. It has the appearance of steel, but does not rust. The walls of the Glasgow Science Centre, for example, are clad in a titanium skin.

Medical Uses of Titanium

Almost by accident, new properties of titanium were discovered in the late 1960s. The properties suggested a unique potential in the medical field. When titanium is fixed in contact with bone for more than a few months, the bone grows into it and this process is known as osseointegration.

No adverse reactions have been observed till date from the body's immune system, nor has the metal shown evidence of even the slightest toxicity. The best part of this metal is that it does not get corroded by body acids either.

Today, titanium is now seen as the ideal material for the use in bone replacement and strengthening operations. Earlier, stainless steel was the metal that was traditionally used for this even though this is rigid and does not flex well with bone. However, the stainless steel does bond with bone in the same way as titanium.

Though pure titanium is too soft for use in hip-joint replacement, it is easily strengthened by alloying with other metals. Traditional hip replacement therapy remains effective. Titanium joints last very much longer. Extensive use in dentistry and cleft palate repair has also been undertaken; many prostheses are still performing their tasks. The potentially fatal weakness, known as an aneurism, in which artery walls bulge dangerously, can now be successfully treated with a titanium mesh implant.

Other Uses

Titanium in powdered form is used to produce sparks in many fireworks. It has density that is greater than that of aluminum, but less than those of iron and copper. The lightness when combined with its strength and ability to withstand high temperatures makes it virtually the designer material for the construction of aircraft parts, jet engines and spacecraft.

As technology advances, the demands for this versatile metal of low density, high strength and zero toxicity is sure to multiply.

What is RNA?

Almost everyone has heard of DNA and knows the role it plays in heredity. But what exactly is RNA?

RNA or Ribonucleic acid is similar to DNA in many ways at the structural level. However there are certain differences that are present in RNA chemistry that make it very different than DNA.

RNA serves many functions in a cell and is typically a linear polymer that consists of a sugar-phosphate backbone with nitrogenous bases projecting off the backbone. This structure is very similar to DNA. Both of these nucleic acids carry genetic information, which is based on the order of the bases that are present along the chain of the molecule. The presence of a single atomic change in the sugar molecule used in the synthesis of RNA makes its chemistry different from that of DNA.

Sugar-Phosphate: Backbone of RNA

The backbone structure of the RNA polymer encodes no genetic information but provides the linear, molecular pole of which the different nitrogenous bases are hung. Just as in DNA, the sugar molecules are joined together through "phosphodiester bonds". This means that the sugar molecules actually have phosphate groups that are already attached to them. In fact, every sugar molecule containing "nucleotide" is used as a precursor in the synthesis of a nucleic acid. This molecule must contain a chain of three phosphates, which is separated by oxygen (O-P-O-P-O--P--O) and is attached to one specific carbon atom of the sugar, which is known chemically as the number 5 position.

Similarities between RNA and DNA

RNA and DNA both encode specific genetic information. Both molecules use nitrogenous "bases" to convey this information. Adenine, guanine and cytosine (the letters A, G, and C) are used in both. The bases are attached to the sugar molecule through a bond at the number 1 carbon atom.

Structurally, both RNA polymers and DNA polymers are able to form a helical structure. DNA is well known for being present in cells as a double helix, where two strands of complementary DNA intertwine with each other. Most RNA inside a cell is synthesized as a single stranded molecule. Yet, it is well known for forming a large amount of double stranded regions when complementary sequences of bases within a single molecule form self-complementary double helices.

Thus, RNA is not very different from DNA and is just as important as our DNA.

The Dangers At Home

It is so refreshing to get back inside the house after a tiring day, leaving behind the noise, air and light pollution of the traffic. But did you know that pollution is as serious a problem indoors as it is outdoors?

The Unseen Dangers

As cities grow, buildings have become more crowded, with stuffy rooms and poor ventilation. Because of this, many pollutants get trapped in the indoor air and their concentration increases over time. Let's have a look at some pollutants.

Fossil Fuels: Whenever you cook food at home, some of the LPG you use escapes unburnt. LPG contains gases like hydrocarbons, carbon monoxide and nitrogen oxides. Though released in quantities that are too tiny to detect or cause immediate harm, over time these gases can accumulate due to poor ventilation. Less fortunate families that use kerosene or firewood face even greater dangers. These pollutants can cause asthma, heart disease and cancer.

Smoking: It is sad but true that many people smoke at home. Smoke from bidis, cigars and cigarettes contains about 4000 different compounds. Some of the dangerous ones include formaldehyde, nicotine, aromatic hydrocarbons and particulate matter. Apart from harming the smoker, people around the smoker are also affected. Smoking is a major cause of asthma, cancer and lung infections.

Volatile Substances: We use many organic chemicals around the house, school or office for various purposes, including floor cleaners, paints, disinfectants, detergents, furniture polish, and laminates. These contain compounds like formaldehyde, toluene and acetone, which evaporate at room temperature. Much of the formaldehyde indoors comes from construction materials like plywood, particle boards, and insulating foam. These substances can cause skin rashes, irritate the eyes and lead to allergies.

Pollen and spores: Homes where the humidity is high (i.e. a lot of water vapour in the air) encourage the growth of fungi, moss and bacteria, which release spores into the air. These flourish in places like attics and corners that are difficult to reach and clean. House plants reared for their pretty flowers release pollen into the air. Pollen and spores cause asthma and allergies in sensitive people. Bacteria and fungi cause infections in the respiratory and digestive system.

Radioactivity: There's radioactivity all around us, because of the small quantities of uranium present in the soil. Over time this uranium decays to form radon gas, which accumulates in the house if poorly ventilated. Radon also escapes from cement, where it was originally trapped during its manufacture.

Making homes healthier

Reducing the effect of these pollutants requires just a few simple measures. Proper ventilation of the house is the best way. Every day, it pays to switch off the A/C for a few hours, open all the windows fully and switch on the exhaust fans. Don't allow anyone to hurt you or themselves by smoking indoors. When cooking food, ensure your burner burns with a bright blue flame (complete burning) rather than a flame tinged with yellow (incomplete burning).

Chromatography

How chromatography works

First, we need to understand the principle of differential solubility. The 'solubility' defines the maximum amount of a substance that will dissolve in a given volume of solvent. A substance will have different solubilities in different solvents, e.g. sugar dissolves a lot in water, but not in oil, while wax dissolves in oil but not water (you can try this at home).

So if you had a mixture of substances, you could add it to a mixture of solvents. The substances in the mixture dissolve in the solvent which they are more soluble in. This separation is what is called chromatography. You can then separate the solvents, and find what substances (and how much) got dissolved in them by analytical methods.

Types of chromatography

There are many types, based on the nature of the solvent.

The simplest is paper chromatography. The substance to be tested is placed on a filter paper, which is then dipped in a mixture of solvents. Common solvent mixtures are water and acetone, water and alcohol, or a mix of all three. As the solvent travels up the paper, different components of the substance dissolve in their solvents. As the solvent moves, the dissolved substance moves along with it.

Filter paper is made of cellulose, which has a strong affinity for water; hence water travels the fastest up it. What's dissolved in water will rise with it and move to a greater distance than what's dissolved in another solvent. When the solvent has risen almost to the end of the paper, it is taken out, dried and subjected to chemical testing.

Other types of chromatography

For advanced analysis, scientists use column chromatography, in which the solvent rises up a column of specially prepared matrix, rather than paper. In gas chromatography, the solvents are in the form of gases. In high pressure liquid chromatography (HPLC, pictured), the separation happens under high pressure.

Affinity chromatography is a special type, in which the chromatographic column itself acts as one solvent. As the substance passes through the column, it attaches to the medium, while impurities pass out with the solvent. This is very useful in purifying drugs.

You can try this interesting experiment. Take a narrow iron pipe a few cm long, and attach a small magnet on the inside. Now make a mixture of iron filings and sawdust in water. Pour it slowly into the iron pipe and collect the outflow at the other end. Pour the outflow down the pipe again a few times. Do you notice the iron filings stick to the magnet, and the sawdust come out in the outflow? You just experienced affinity chromatography!

E-waste: Reduce, Recycle, Reuse

Nowadays, we've hardly bought a new mobile phone or computer that new models appear. Have you ever wondered what happens to those old phones and laptops we stopped using?

E-waste: a problem and an opportunity

Everyday, millions of tonnes of refrigerators, televisions, mobile phones and computers are discarded around the world. Together, these are called electronic waste or e-waste. These are very complex things, containing metals like copper, tin, cadmium, mercury and lead, as well as plastics and wood. Disposing of them is now a major international problem.

E-wastes are not degradable by soil bacteria. Nor can they be destroyed by burning. When they are dumped in landfills, they occupy too much space and leak out dangerous chemicals into the air or soil. If these enter sources of drinking water like rivers or wells, they can cause serious health problems in humans, animals and plants alike.

Methods of dealing with e-waste

You can deal with your e-waste in three easy ways. Reduce, Reuse and Recycle.

The first is the hardest. Let's not buy a new phone or TV till the one you have is worn out completely. But then, when we see new models advertised all around us, it's hard to resist temptation.

The second way is to offer them to someone to reuse. The next time we buy a new computer or gaming console, let's donate the old one to a charitable organization. They will use them to teach those less fortunate than us.

Some companies will offer to exchange their old products for new ones. They can then remove several parts that are not worn out from the old ones and use them again in new devices.

And lastly, we can help by recycling. The lead, cadmium, mercury etc. that are present in discarded electronics can be extracted for several other uses. Many electronics stores now have collection points where we can dispose of old phones, PCs etc. These are then shipped to recycling plants.

Next time you buy an electronic gadget, buy one from a maker that has a recycling policy.

What happens in a recycling plant

In a typical e-waste recycling plant, electronic appliances are first crushed and pulverized. Metallic and non-metallic components are then separated using magnets and chemical methods.

The metallic components are smelted down to recover the original metal again. This is specially done for metals like gold or platinum. Other metals like iron are oxidized, so that they can be returned to the environment in a harmless state. Wood is ground into sawdust, which is used as packaging material. Plastics can be more tricky, but they are recycled to make buckets, jars etc.

III. Изложите содержание следующих статей в виде реферата:

Biochemical Evolution

How life evolved?

Now picture this, imagine swimming in a cosy volcanic vent of searing heat. Ammonia and methane swirl like a cosmic bowl of soup. Steam rises from the water into the thick chemical atmosphere. Suddenly, a bolt of lightning strikes the sky. The ammonia and methane combine just at the water's surface and are fed by the heat from below. At that moment something new appears: an amino acid; a protein; which is a building block for life itself. According to scientific convention, that's how it happened over 3.8 billion years ago here on Earth.

Ever since Darwin sailed to the Galapagos and wrote his first theories of evolution, scientists have been trying to find the origins of life. Humans had been trying to find this very thing long before Darwin ever hypothesized that human beings evolved - as all animals did from organic compounds. But in recent years more evidence has been found through evolving technology and research. Science and mankind have been provided with some new answers about an old problem. If we did evolve from simple compounds in a complex environment, then how did it happen?

Scientists currently believe that planet Earth formed around 4.5 billion years ago after the "Big Bang" created our universe. Then, sometime around 3.8 billion years ago, the first rock formations began to appear, and microorganisms known as archaebacteria developed. Around 7 billion years in between, life began as a result of a specific set of necessary elements, and random chance.

Beginnings of Biochemical Evolution

We know that the so-called "primordial soup" of our world was made up of lots of water on the surface, and great quantities of methane and ammonia in the atmosphere. Below the surface of the water, volcanoes were continuously erupting and underwater land masses were being created. These land masses eventually rose to the "surface".

The volcanoes were also creating a lot of heat and steam. A great storm of chemical activity in the skies of that primordial Earth was also getting added to the heat and steam mixture. The movements of Earth, sky, and chemicals resulted in electrical storms. Based on recent studies in microbiology, biochemistry, and chemical palaeontology, scientists believe that either electrical activity or a catalytic metallic ion was created which led to the creation of amino acids.

Amino acids are the simplest forms of an organic compound. They are also proteins. DNA and RNA derive from the successful building of protein. Once DNA and RNA begin to build upon themselves, complex organic materials are created including living cells such as bacteria, and amoebas. By 3.5 billion years ago cyan bacteria had developed.

Around 2.2 billion years ago, photosynthetic bacteria had utilized enough chlorophyll and emitted "waste" to create an oxygen rich atmosphere. It was approximately 2 billion years ago when bacteria developed into eukaryotes which were regarded as the first complex living cells. Many of the ancient water-bearing bacteria can still be seen today in the fossilized mounds called as stromatolites along different beaches around the world. These stromatolites are serving as a great evidence that scientists are using to investigate the era of the primordial soup. At first, scientists did not realize that these mounds were in fact fossilized bacteria.

The Contribution of Bacteria

Bacteria are found in all shapes, sizes, and conditions. Bacteria can thrive in just about any environmental condition right from extreme heat to extreme cold. As a result, scientists have been exploring the Arctic and Antarctica to find clues to Earth's bacterial past. Bacteria fossils as well as young living bacteria have been found hidden in these harsh places. Scientists have also found bacterial fossils in salt beds that are hidden below the Earth's surface.

With the sedimentary layering of Earth over time, crystals are formed when moisture is trapped. Scientists found ancient Bacillum bacteria in salt crystals that were found in the New Mexico desert. The samples were revived and new spores were produced after millions of years of imposed hibernation in salt crystal. The estimate for this particular sample is 256 million years old. The discovery takes us one step closer to the study of the elements and events that spawned life on our world 4 billion years ago.

In the end, we may never know what exactly happened in that ammonia and methane filled world of chemical storms and volcanic heat. But with each day of new inventions, technological advances in biochemistry, we will learn more: more about our world; and ourselves.

The Colourful Truth About Dyes

We all like to wear colourful clothes. Whether a special occasion or just daily wear, it's always nice to add a little colour in our lives. Dyes are the chemical substances that are responsible for turning plain cloth into the colourful garments that we wear every day.

What are dyes?

Dyes are substances applied in aqueous based solutions to a fabric to give it a colour. What makes a dye different from a pigment is that pigments are usually insoluble. Most of the dyes that we know are natural dyes found in the plant kingdom, available from a number of roots, berries, bark, leaves and wood.

The structure of dyes

You may have noticed that sometimes when you wash your clothes the colour seems to seep out of them. As a result when you dry your clothes, they seem to become faded. Some dyes just stain fabrics and get washed away bit by bit whenever you wash your clothes. Good dyes on the other hand chemically attach themselves to the molecules of the fabric that you are dyeing.

Different dye molecules are unique. Each is shaped differently so that it absorbs light in a different way. This results in the colour of the dye being different. Often a third molecule is added to a dye. This acts as a bond between the dye molecule and the molecule of the fabric that the dye is being applied on.

The study of dyes made organic chemistry popular and even led to the invention of drugs based on the chemical intermediates of dyes, like the invention of aspirin and sulfonamides.

Synthetic dyes

Today there are a variety of synthetic dyes in use. These are more popular than natural dyes because of the wide range of colours that they offer and because they are cheaper and better than the natural ones. The first synthetic dye used, mauveine, was discovered in 1856 by teenage William Henry Perkin. He created this dye out of coal tar.

Today synthetic dyes are classified by how they are used to dye fabrics.

Acid dyes are highly reactive water soluble dyes that are used to colour fabrics like silk, wool and nylon.

Mordant dyes use a substance that fixes the dye, making it resistant against water, light and perspiration. These dyes are usually used for colouring wool.

Basic dyes are used with acetic acid to dye acrylic fibres.

Vat dyes are not soluble in water and need to be reduced in alkaline liquor to get a water soluble, alkali metal salt of the dye. This can then be easily applied onto the fabric. When the fabric is subject to oxidation the original insoluble dye is reformed.

Disperse dyes are used to dye fabrics of polyester and are available as a paste or powder.

Sulfur dyes are the dyes that are used in large quantity. These dyes are applied in two part dyes. The first part produces a pale yellow colour while the second part uses a sulphur compound to produce dark shades and black.

Why are dyes important

The study of dyes made organic chemistry popular and even led to the invention of drugs based on the chemical intermediates of dyes. This includes the invention of aspirin and sulfonamides.

Research in dyes is also responsible for colour photography as we know it. In 1873 the German photo chemist Hermann Wilhelm Vogel added dyes to film that was only sensitive to blue and UV light, allowing the film to capture the colour green. By 1907 the French Lumiere brothers had perfected a colour process for the public called Autochrome. Today dyes are also widely used in printing, where the colours of cyan, yellow, magenta and black combine to farm all the colours visuals that you see printed.

A Few Facts About Fuel Cells

Have you heard of the electric car? These cars are very similar to the normal cars. What makes these cars different is that they use large batteries to power them instead of using petrol. What make these environmentally friendly cars possible are fuel cells.

Understanding fuel cells

A fuel cell is an electrochemical cell that is used to produce electricity with the help of combustible substances like hydrogen, propane, methane, arid diesel and in some cases even gasoline. A fuel cell does not require the chemical energy to be converted to mechanical energy for use. This conversion process usually wastes a lot of energy.

History of fuel cells

The fuel cell dates back to 1838, when German scientist Christian Friedrich Schönbein came up with the idea of a fuel cell. This idea was further experimented by Welsh scientist Sir William Robert Grove in February 1842 who created a working device that operated on the principle of fuel cells. Much later in the 1950's, W. Thomas Grubb and Leonard Niedrach, scientists working for the General Electric Company (GE) further improvised on the design by using hydrogen as the main source of fuel. This design of the fuel cell was used in various American space missions conducted by NASA.

Benefits of fuel cells

Essentially fuel cells are like a battery that does not require charging. As long as there is a source of fuel, it can keep producing electricity indefinitely. The advantages of fuel cells are numerous. Fuel cells unlike combustion engines are very easy to refill and will keep working as long as there is a fuel source. They are highly efficient and operate without making much noise unlike combustion engines. Fuel cells also do not release any harmful pollutants. Fuel cells are easy to maintain, as there are no moving parts, and absence of friction.

The chemistry of fuel cells

Fuel cells work on an electrochemical reaction that converts chemical energy into electricity using a fuel source in the process. There are different types of fuel cells all of which have slightly different electrochemical reactions. However, the overall process is always the same. Fuel is oxidized at the anode, the electrons flow through a circuit and the fuel is reduced at the cathode. Hot air and water is generated from the waste heat produced by the operation of the fuel cell.

Fuel cells that run on hydrogen are compact and very lightweight. What is more they have a combustion efficiency of just under 100%. Many large automobile companies like Chrysler have developed cars and buses, which run on fuel cells. If the majority of cars are made with fuel cells instead of combustible engines it will reduce our dependence on fossil fuels and it will be a major step forward in solving the problem of global warming. Cars that run on fuel cells enjoy zero tailpipe emission. This means that no harmful pollutants are released. Even in India you can find cars that use fuel cells such as the Reva.

In addition, it is just not cars and buses. The world's first official fuel cell boat HYDRA was made in Germany and there is even a submarine that runs on fuel cells. It has the capacity to hold 22 people. Companies are developing cars, buses, scooters, forklifts, boats, trains and even planes that will work on fuel cells.

The Fundamentals of Fermentation

Though you may never have heard of fermentation, you are likely to have experienced it. Fermentation helped make that piece of toast you had for breakfast. It is also responsible for making yoghurt, wine and beer.

The discovery of fermentation

Fermentation has been used to make alcoholic beverages like mead, wine and beer as early as 7000 BC in the Middle East. It was Louis Pasteur, who was the first person to discover the science behind fermentation. Yes the same Louis Pasteur who discovered the cure for rabies. In 1857 he described fermentation as the process that brought about the changes in yeast and microorganisms in the absence of air. It was later in 1907 that the Nobel Laureate Eduard Buchner discovered that fermentation is caused by a yeast secretion called zymase. By 1920 scientists realized it was not only yeast that was responsible for fermentation but, it also occurred in other substances of glucose utilization.

What is fermentation?

Fermentation is the conversion of a carbohydrate like sugar into an acid or alcohol. This is a chemical process in which micro organisms including bacteria, yeast and mould break down sugar. The result is the release of water, alcohol and carbon dioxide. Fermentation also creates lactic acids in certain foods. It occurs naturally in different foods including a variety of grains, fruits, juices, and other organic liquids. Milk is fermented to give a variety of products including Yoghurt, and other milk products like Indian Lassi and the Yakult of Japan and China.

Why is fermentation useful?

Fermentation is a process in which you can preserve food. By fermentation the food retains its enzymes, vitamins and other nutrients that are usually destroyed by other food processing, as there is no heat involved in the process. Foods that are fermented have an additional nutritional value. They are rich in vitamins like B and minerals like iron. This means that fermentation of food is an ideal way to preserve the food without losing nutrients.

Though fermentation is a natural process, man has discovered how to ferment things in a controlled process. This is essential for making things like yoghurt and alcohol on a large scale.

The Sparking Truth About Diamonds

Diamonds are always called a girl’s best friend. They are formed from carbon and are used for a variety of purposes from jewellery to use in lasers and cutting and polishing tools. Though most diamonds are colourless you do come across a few; rare coloured diamonds.

Diamonds derive their name from the Greek word for unbreakable - adamas. They are the hardest, naturally occurring substance on the planet. Diamonds are one of the several allotropes of carbon. Diamond is considered less stable than graphite. The chemical makeup of diamonds ensures that they have very few impurities, making them ideal for optical applications. They are also excellent conductors of heat. So if you ever place a large diamond in your mouth it would be quite cool to feel.

When deposits of carbon are exposed to high pressure and temperature a diamond is formed. Diamonds can be found up to 140 kilometers beneath the surface of the planet. Diamonds have also known to be formed at depths of 300km as well. The ideal combination of pressure and temperature is found mostly deep under ground under layers of the earth known as continental plates. Today diamonds are made synthetically by a high pressure, high temperature process that mimics the natural forces that produce diamonds.

Diamonds in India can be traced back to 4th Century BC. In fact it was one of the first countries to actively mine these precious gems. Some of the areas that these gems were mined from include Golconda, and Raolconda. It is from Golconda that the famous Kohinoor Diamond and Hope Diamonds were mined from.

Diamonds can come in different colours depending upon impurities in them. The colours can range from intense pink, blue and even red! One of India's heirlooms is the Hope Diamond. What makes this diamond unique is its blue colour. This 45.52 carat diamond is blue in colour. The colour is caused by small amounts of boron in the diamond. The greater the quantity of boron in a diamond, the more is the blue colour in the diamond. Some diamonds have nitrogen atoms infused in the diamond giving it a yellowish colour.

Для заметок

Лексико-грамматический блок

Лексические упражнения

1.Прочитайте и переведите на русский язык предложения, запомнив значения составных предлогов.

according to	согласно
aside from	помимо, кроме
apart from	помимо, кроме
because of	из-за; в силу; благодаря
on account of	из-за; в силу; благодаря
owing to	из-за; в силу; благодаря
thanks to	из-за; в силу; благодаря
due to	из-за; в силу; благодаря
to be due to	быть вызванным, обусловленным
by means of	при помощи, посредством
compared to (with)	по сравнению с
depending (up) on	в зависимости от
except for	кроме, исключая
in addition to	кроме, помимо
in spite of	несмотря на
instead of	Вместо
regardless of	независимо от
in terms of	исходя из; на основе; в виде
previous to	до, перед
prior to	до, перед
with respect to	в отношении
with (in) regard to	в отношении
by virtue of	в силу, на основании
irrespective of	независимо от

1. Mendeleyev arranged the elements **according to** the magnitude of their atomic weight. 2. **Aside from** supplying power, the development of atomic energy has brought many other important benefits. 3. **Apart from** other uses sulphur dioxide has come to be used as bleaching agent for silk, wool, and other materials. 4. There are many physical and chemical changes in which participating substances cannot be directly observed **because of** their small amounts, fast rates of reaction or hazards in handling. 5. **On account of** its inertness it is difficult to make nitrogen combine with other elements and its compounds are unstable. 6. The fact that the number of electrons increases with increase in temperature can **account for** the high negative temperature coefficient of resistance in semiconductors. 7. In gases molecules are in free motion and not being confined by the shape of a container

they are far **apart from** one another. 8. The elements are arranged in the Periodic Table **in accordance with** their atomic number. 9. The details of this important chemical installation are not yet described so that no **account of** its construction and operation can be given here. 10. Carbon unites with iron **due to** the chemical affinity characteristic of these groups of elements. 11. The conductivity is mainly **due to** free electrons. 12. **Due to** its greater energy content ozone is more reactive than oxygen. 13. The bleaching effects of sulphurous acid are **due to** its reducing properties. 14. As the temperature rises the surface of the steel passes gradually through a series of beautiful colours **due to** films of oxide of iron. 15. The following classification of coal is **due to** Dr. Percy. 16. When coal is exposed to the action of the atmosphere, it undergoes certain changes **due to** the action of oxygen in the presence of moisture. 17. It has not yet been determined whether the change is **due to** the escape of volatile matter or to oxidation. 18. The difference between the two kinds of product is largely **due to** the amount and nature of impurities. 19. The electric charge of the proton is equal in magnitude to the charge of the electron, but it has the opposite sign+ **instead of** — **.** 20. Even liquid ammonia is a fairly good solvent for ionic compound, **in spite of** the fact that its dielectric constant is very much smaller than that of water. 21. Radiant energy is described in this paper **in terms of** the electromagnetic spectrum. 22. Iron is usually used when hydrogen is prepared **by means of** the reaction between water and a metal. 23. The property **by virtue of** which a body offers resistance to a change in its motion is called inertia. 24. Carbon dioxide cannot be liquefied above 31-35° **irrespective of** the pressure that is applied. 25. Chemical reactions occur at different rates **depending upon** the conditions and the nature of the reactants. 26. The liquids were selected **with regard to** their degree of polarity and the temperature range which permits them to remain in the liquid state. 27. The most useful form of expressing concentrations for every day laboratory activity is **in terms of** moles of solute per liter of solution. 28. A solid portion of matter retains its form and occupies the same space **irrespective of** the container it is placed in. 29. The electrons and the nucleus are very small **as compared to** the size of the atom. 30. Acceleration is the rate of change of velocity **with respect to** time.

2. Прочитайте и переведите на русский язык следующие пред-

Affect *(v)*	**affect** *v* - влиять на, воздействовать на **to be unaffected** — не подвергаться влиянию, оставаться без изменения **to be affected by** — подвергаться влиянию (воздействию) **is (are) affected by** — на**…** влияет **is (are) unaffected by —** на… не влияет

ложения, обращая внимание на значения производных от глагола affect.

1. Chemical activity is **affected** by temperature. 2. It is the state of water but not its composition that can be **affected** by the process of heating or cooling. 3. Among the substances **unaffected** by oxygen one should mention the inert gases. 4. The molecular weights **are unaffected** by the temperature change. 5. The properties of oxygen **are unaffected by** the presence of the other gases in the air. 6. The results of our experiments were greatly **affected** by the presence of impurities. 7. The atomic weight is the one property of an element, which remains **unaffected** by chemical changes. 8. The solubility of most solids in water is increased by heating but some are little **affected by** temperature change and a few less soluble in hot than in cold water.

3. Запомните значения слов, прочитайте и переведите на русский язык следующие предложения.

All	**all** — весь, вся, всё, все **above all** — главным образом **after all** — в конце концов **all over** — повсюду **at all** — вообще, совсем **first of all** — прежде всего **all the same** — тем не менее, все же

1. After **all,** the rays of the sun as a source of power can be put to work without much costly machinery. 2. First of **all** you have to know the most important chemical laws underlying these natural phenomena. 3. **All** of this kinetic energy may be used to do work as the moving object is slowed down to rest. 4. The basic principles of good balance design should be known to **all** working in chemical laboratories. 5. The life at other planets, if it exists at **all,** is not like ours. 6. Hydrogen and chlorine are known to react together with explosive violence, if they are exposed to sunlight, but perfectly dry hydrogen and perfectly dry chlorine fail to react at **all.**

4. Запомните значения attmount, прочитайте и переведите на русский язык следующие предложения.

Amount	**amount** *n* - величина, количество **amount (to)** *v* - равняться, достигать, составлять

1. The basic substances **amount** to from 5 to 10 per cent of the tar, while 1 to 2 per cent is the usual **amount** of such substances in ordinary coal tar. 2. There are many physical and chemical changes in which the substances involved cannot be directly observed because of their small **amounts,** rates of reaction, and hazards in handling. 3. The total amount of radium produced up to 1940 **amounted** to about one kilogramme. 4. Since radiant energy is a wave phenomenon it is necessary to compare the properties of waves with the

amounts of energy associated with those properties. 5. From the view point of fuel economy some industrial boilers were equipped with smoke eliminators which not only greatly reduced the **amount** of smoke emitted but also decreased the **amount** of coal required for the same **amount** of steam by 5 or 6 per cent. 6. The rate at which a chemical change took place was greatly increased by the addition of certain substances in a minute **amount.** 7. The portion of radium in a ton of pitchblende ore **amounts** to only 1/5 g. 8. In carrying out the nitration, the proper **amount** of mixed acid (consisting of equal parts of sulphuric acid and nitric acid) is introduced into the steel nitrating vessel.

5. *Запомните значения составных слов с as, прочитайте и переведите на русский язык следующие предложения.*

As	**as** *cj* — как; в качестве; чем; так как; в то время как**;** по мере того как **as** *adv* — как (например) **as well —** также **as... as** — так же..., как и; такой...как (парный союз) **as far as —** насколько **as long as —** пока **as soon as —** как только **as well as —** так же, как и **as if** – как будто **as for, as to** – что касается

1. The reaction with lead is very slow, **as** might be expected with the metal. 2. The atomic weight of an element is defined **as** the mass of one atom of an element compared with the mass of one atom of hydrogen. 3. **As to** the advantages of this method they leave no doubt. 4. He was surprised **as if** he had never seen such a device. 5. Energy is defined **as** the ability to do work. 6. **As soon as** he saw bubbles on the surface of the liquid he stopped the experiment. 7. Carbon **as well as** metals conduct electricity. 8. One can see that gases expand **as** the temperature rises. 9. **As** the electron vibrates between energy levels, it radiates electromagnetic energy in constant amounts. 10. Hydrogen peroxide acts **as** a vigorous oxidizing agent but strangely enough it also acts **as** a reducing agent. 11. A solid can be changed to a liquid and further to a gas, **as** the temperature goes still higher. 12. **As** early **as** at the beginning of the 19th century Dalton laid the scientific foundation of the atomic theory. 13. Aluminium **as well as** copper are the best conductors of electricity. 14. The existence of neutrons in nuclei was discovered **as** late **as** in 1932.

6. Запомните значения because, прочитайте и переведите на русский язык следующие предложения.

Because	**because** *cj* — так как, потому что **because of** *prep* — из-за

1. The compounds involving radicals are often ionic **because of** the transfer of electrons. 2. If the temperature varies greatly from the 20°C indicated, the precision of measuring is reduced **because** the volume occupied is more at higher temperatures and less at colder temperatures. 3. There are some solutions, such as hydrofluoric acid and strong alkalis (sodium and potassium hydroxide), that should not be stored in glass vessels **because of** chemical interaction. 4. An aluminium ion in water solution has a strong attraction for water molecules **because of** its considerable positive charge. 5. In the oil-water separation, the water will be the low phase **because** it is slightly denser than oil. 6. **Because** carbon monoxide is odourless, the presence of this gas is not easily detected. 7. Phosphorus is never found free in nature **because of** its strong affinity for oxygen. 8. It is important to add the sulphuric acid to water rather than adding water to sulphuric acid **because** the intense heat produced in the solution process could cause the first drops of water to splatter some acid on the experimentator and cause burns. 9. Any substance which causes the loss of electrons **because of** its own tendency to gain them is called an oxidizing agent. 10. -SH group is found in many proteins and has a certain infamy **because of** the unpleasant odour associated with it. 11. While this method is not the most common or most useful it is necessary to consider it **because** it is still used in laboratory experiments. 12. A phase separation between liquids can usually be observed as two distinct layers **because of** the different light refractive properties of the liquids. 13. Argon, helium, neon, krypton and xenon are called the inert gases **because** they are chemically inactive. 14. Hydrogen diffuses more rapidly than any other gas **because of** its very small density.

7. Запомните значения следующих слов, прочитайте и переведите предложения.

Before	**before** *prep* – перед, до, раньше *cj* – прежде чем, до того как *adv* **–** впереди, раньше, прежде
After	**after** *prep* - после, вслед за *cj* – после того, как *adv* - потом, после

1. The cosmic rays spend many millions of years in flight almost at the speed of light **before** they reach our planet. 2. In order to know what happens when a metal rusts one must study its properties **before** and **after** rusting.

3. Liquid lead assumes the spherical shape because of the effect of arsenic **after** the outer portion of it has solidified. 4. Some substances will ignite even when very slightly heated, others have to be heated to a high temperature **before** they take fire. 5. **After** the crystals are pressed dry, they are placed in 1.5 l of cold water, washed thoroughly, filtered through paper and dried in the air. 6. **Before** the discovery of the structure of atomic nuclei, it was thought that there existed two general types of forces explaining all natural phenomena: electrical and gravitational. 7. The word "helium" comes from the Greek word "sun" because that element was discovered in the sun **before** it was discovered on the earth. 8. All the necessary and exact data you can find in the reference book lying **before** you. 9. **Before** the isotopes can be applied either in industry or in medicine they must be converted into forms that are both safe and convenient to use.

8. Запомните значения слов, указанных ниже, прочитайте и переведите на русский язык следующие предложения.

both... and	как..., так и; и.... и
either... or	или... или; либо... либо
neither... nor	ни... ни
whether... or	будь то... или; независимо от того... ли
whether or not	ли (ставится после сказуемого)
the... the	чем..., тем (в сочетании с прилагательным в сравнительной степени)
as... as	так же..., как и; такой же...,как и

1. **Both** calcium **and** zinc chlorides are extremely soluble in water, but practically insoluble in liquid ammonia. 2. **Both** liquid ammonia **and** water possess high fluidity. 3. Oxidation may be **either** slow **or** rapid, in both cases the same amount of heat is liberated provided that the same kind and quantities of substances undergo oxidation. 4. **Either** of the methods described will give the desired results. 5. Acids may be **either** gases, liquids or solids. 6. In the case of the electrolysis of a solution of copper chloride, using a carbon anode, copper is liberated at the cathode and chlorine at the anode, so that complications at **either** electrode are avoided. 7. Gases have **neither** a definite volume **nor** a definite shape. 8. **Neither** of these devices have been used in industry for the last decade. 9. The reaction rate is often affected considerably by neutral salts which are **neither** acidic **nor** basic. 10. This method is used **whether** the product is pure or contaminated. 11. In any element **whether** it is gold, copper, mercury, hydrogen or any other element electrons are always in motion. 12. **The** higher energy radiation has much shorter wavelength and

thus much higher frequency. 13. **The** more carbon the steel contains, **the** harder it becomes. 14. You must work at your English **as** much **as** you can. 15. This is probably **as** satisfactory a definition **as** can be formulated concisely.

9. Запомните значения следующих глаголов и переведите предложения.

Bring about *(v)* **-** вызывать; осуществлять	—	**bring** *(v)* **–** приносить
build up *(v)* **-** образовывать	**—**	**build** *(v)* **–** строить
carry out *(v)* **-** выполнять	—	**carry** *(v)* **–** нести
give off *(v)* **-**выделять	—	**give** *(v)* давать
give up *(v)* **-** выделять	—	**give** *(v)* давать
make up *(v)* **-** составлять	—	**make** *(v)* **–** делать
make up for *(v)* - восполнять	—	**make** *(v)* **–** делать
use up *(v)* **-** расходовать	—	**use** *(v)* **–** использовать

1. Over a period of many years there has been devised a large number of apparatus **to carry out** chemical tasks. 2. Synthetic chemistry deals with the methods by which complex bodies **may be built up** from simpler substances. 3. Each of the sodium atoms **gives off** an electron and forms an ion which goes into solution. 4. **To bring about** the preparation of many organic compounds a great many ethylene hydrocarbons are made use of. 5. Higher temperatures **bring about** more frequent collisions between molecules. 6. Iron **makes up** about four per cent of the solid rocks of the earth's crust. 7. The molecule of hydrogen is **made up** by the union of two hydrogen atoms. 8. Parallel with the processes resulting in a shortage of nitrogen compounds in the soil, other processes also take place in which the losses of nitrogen compounds **are made up for.** 9. If we pass an electric current through water using platinum or gold electrodes we find two gases **to be given off** at the electrodes and the water **to be used up.** 10. Reactions such as synthesis, decomposition, hydrolysis, oxidation, reduction, polymerisation can **be brought about** by exposure to suitable light. 11. The process of making ordinary glass is **carried out** by using such raw materials as sand, limestone, and sodium carbonate.

10. Запомните значения следующих слов и переведите предложения.

Case	**case** *n* **— случай** **in the case** — в случае; **in which case —**в этом случае; **this is the case (such is the case)** — это имеет место, так и есть; **this (such) is not the case** — это не так

1. In any **case** the branched side chains of a polymer are the reactive parts of its molecules. 2. It might be thought that as new plastics are developed the older types would tend to disappear from production, but this is far from being the **case.** 3. As is the **case** in the conversion of organic compounds into nitrates, the first step in nitrogen fixation is the formation of ammonia. 4. Combination with oxygen often liberates heat and light in which **case** the process is known as combustion. 5. According to its properties we should expect chlorine to combine with hydrogen containing compounds. This is really the **case.** 6. Hydrogen and chlorine react violently in direct sunlight but the catalytic influence in this **case** is the light rather than the heat of the sun. 7. The photon of gamma radiation has a very high energy, its flight through the universe from distant stars is measured in light years, in this **case** gamma radiation being called cosmic radiation.

11. Запомните значения слова cause, *прочитайте и переведите на русский язык следующие предложения.*

Cause	**cause** *n* — причина
	cause *v* — вызывать что-либо
	cause + инфинитив — заставлять

1. Sulphur causes steel to be brittle when hot, and phosphorus **causes** it to be brittle when cold. 2. It was discovered that the rays from radium and other radioactive elements may **cause** regression of cancerous growths. 3. Radioactive rays were observed **to cause** the air through which they pass to become a conductor of electricity. 4. If particles of varying size in a suspension need to be separated, the tube can be spun in the centrifuge for a period of time at a speed sufficient **to cause** the heavier particles to move to the bottom of the tube before the lighter particles. 5. A loss of an alpha particle **causes** a transformation of the atom as well as a loss in mass. 6. The change in magnetic force **causes** a flow of current that can be measured by a galvanometer. 7. Leguminous bacteria **cause,** the nitrogen of the air to form a compound which is incorporated into the bacterium body for its own use, and when it dies and decays the nitrogenous compounds are set free in the soil. 8. The slight shifting of the axis of rotation **causes** a circular path to be described by the axis. 9. However, in the case of molecules which readily exchange parts with each other attempts at separation may **cause** molecular rearrangements. 10. The next question to be considered is the nature of the radiation that nuclear decay **causes.**

12. Запомните значения слова effect, прочитайте и переведите на русский язык следующие предложения.

Effect *(v)*	**effect** *v* — осуществлять **effect** n — результат; (воз)действие, влияние **in effect —** в сущности **to this effect —** для этой цели

1. The term "oil cracking" refers to the disruptive effect upon the carbon chain, the process being **effected** at a temperature of about 300°C and a pressure of about 100 pounds per square inch. 2. On April 12, 1961, the Soviet Union **effected** the first manned space flight in history. 3. There are many uses of oxygen that require the substance in a high degree of purity so as to eliminate the **effect** of the presence of other gases. 4. The high pressure produces an opposite **effect** and tends to force the molecules closer together. 5. In **effect,** we would rather attempt to present only a general idea of organic chemistry and **to this effect** a classification of organic compounds and their important physical and chemical properties is given without going into details.

13. Запомните значения следующих слов и переведите предложения.

Facilitate *(v)*	облегчать
facility	установка, лаборатория, завод
facilities	оборудование, средство

1. National economy dictates the decision to produce new products or expand or modernize present *facility.* 2. Designs of new plants must include the necessary *facilities* for purification of wastes. 3. Pilot plant usually *facilitates* the development of new method of production. 4. All this *facilitates* our task. 5. The existence of transport *facilities* has resulted in developing industry in the world.

14. Прочитайте и переведите на русский язык следующие предложения, запомнив слова с far.

Far	**far** а **—** далекий **far** *adv* — далеко **far** *adv*+ прилагательное в сравнит. степени - гораздо, значительно **by far** — безусловно **so (as) far as... is concerned** — что касается **so far as** — насколько, поскольку **so far —** пока, до сих (тех) пор **far from** — далеко от, совсем не **how far** – насколько **as far back as** – еще

1. The small non-metallic atoms exert a powerful attraction on the hydrogen because its electron is so **far** removed that it is almost a hydrogen ion. 2. **Far** greater use of plastics is expected in industrial construction. 3. The process of fractionation may be carried so **far** that a pure crystalline active substance is obtained. 4. Apparatus not immediately required should be kept as **far** as possible in a neat and orderly manner. 5. Coal does **far** more for each of us than supply the necessary heat to move our trains. 6. By **far** the most useful solvents are the hydrides. 7. So **far** as chemical properties of sulphur are concerned it is to be noted that it unites directly with common metals except gold and platinum. 8. So **far** they did not succeed in their efforts to raise the efficiency of the engines. 9. Sulphuric acid is by **far** the most widely used acid. 10. By **far** the commonest materials for chemical plant construction are metals. 11. Prolonged experiments of this kind seem to confirm our view, but they have not been carried **far** enough to enable us to speak quite definitely. 12**. So far** the problem remained unsolved. 13. This substance is insoluble in water **as far as** I remember. 14. The first computer was devised **as far back as** 1939. 15. To establish the fact more completely the theory referred to above would need a **far** wider study. 16. This work had to determine **how far** the differences in the experimental results published could be explained and systematized. 17. **As far as** the application of computers is concerned its range is very wide.

15. Запомните значения следующих слов и словосочетаний, прочитайте и переведите предложения.

For	**for** *cj* **—** так как, потому что, ибо
	prep **—** для; за; в течение; на; в; к
	for+ существит.+ инфинитив — чтобы
	except for — кроме
	as for — что касается

1. The temperature was too low **for** the substance to decompose. 2. The selection of the proper metal for a given use is an important part of the practice of metallurgy **for** often the success of the work is dependent on it.

3. Oxygen is remarkable **for** its great chemical affinity. 4. **For** many purposes steel is much better than iron **for** with the same weight steel has much greater strength and hardness. 5. Salt formation in this solvent will not take place **for** the base has a lower affinity for the proton that the solvent has. 6. It has been known **for** many years that light is able to bring about chemical changes. 7. It was shown that **for** one thing the reaction depends on concentration of reactants. 8. The great number of experiments made by him is enough to get the necessary results **for** such a period of time. 9. As **for** the transmission of energy over long distances electricity is best. 10. It is often very important to know under what conditions will two substances react sufficiently rapidly **for**

the reaction to be of practical use. 11. Now it is believed that atom contains (except **for** oxygen) three kinds of particles – electrons, protons and neutrons. 12. An instrument has been built and tested **for** possible use on a planetary spaceship. 13. In his table Mendeleyev left several gaps **for** the new and unknown elements to be found in the future. 14. The Soviet Union occupies a leading place **for** known oil and gas reserves.

16. Запомните значения следующих слов, прочитайте и переведите на русский язык предложения.

Hard	**hard** *a* — 1) твердый, крепкий; 2) трудный **hard** *adv* — усиленно **hardly** *adv* — едва ли, едва, почти не

1. Oxygen is **hardly** soluble in water. 2. Gold **is hardly** affected by nitric, sulphuric or hydrochloric acid. 3. A sample of solid has definite volume and is **hardly** affected by changes in pressure. 4. It is **hardly** possible to call the organic chemistry "dreadful jungle" for it is now a highly organized discipline which is constantly expanding in a purposefully controlled manner. 5. Zinc is a bluish-white, moderately **hard** metal. 6. Corundum (aluminium oxide, ALOg) is the **hardest** of all naturally occurring substances except diamond. 7. The problem at first sight seemed very **hard.** 8. Many hard-working and intelligent technicians continue their education at evening departments.

17. Изучив значения слова involve, *прочитайте и переведите на русский язык следующие предложения.*

Involve *(v)*	**involve** *v* — включать в себя; вызывать что-л.; быть связанным с чем-л. **involved** (in) —сложный; связанный с..., занимающийся; рассматриваемый; данный, имеющийся **involving** — с, связанный с... **not involving —** без

1. The investigation of this type of reaction **involving** considerable experimental difficulties was of great importance. 2. Approximate methods for the solution of the equations **involved** are introduced in two ways. 3. They have dealt mainly with the general principles **involved**. 4. The essential experimental procedure **involved** the observation of fall in temperature of a liquid. 5. The problem **involved** deals with inert gases. 6. The discovery of the instrument **concerned** belonged to Torricelli. 7. The existence of rarefied atmosphere may be proved by the device **concerned**. 8. The question **involved** will be discussed later. 9. In order to determine whether a compound **concerned** is organic it is frequently sufficient merely to heat it.

18. Изучив значения слова make, прочитайте и переведите на русский язык следующие предложения.

Make *(v)*	**make (made)** *v* — делать **make** + существительное; инфинитив без частицы to — заставлять (если глагол to make употреблен в Passive, инфинитив имеет частицу to) **to make use of** — использовать **to make up** — составлять **to make up for** — восстанавливать, восполнять

1. The question is what **makes** a chemical reaction go. 2. When Mendeleev reached iron he had to **make** an eighth column with the three elements iron, cobalt and nickel in it. 3. Ammonium sulphate as a fertilizer was formerly obtained by combining ammonia with sulphuric acid but now use is very extensively **made** of calcium sulphate. 4. After passing over the catalyst, the gases are washed with water, so as to dissolve ammonia, while the unchanged nitrogen and hydrogen are **made** to circulate again over the catalyst. 5. No plans were **made** to analyse the new substance. 6. The laboratory assistant was **made** to repeat that experiment. 7. We made that test **to make** you realize that it was necessary to raise the pressure by three atmospheres. 8. There are other processes in nature by which nitrogen is **made up for.** 9. Each nucleus contains enough protons to account for the positive charge of the nucleus, the balance in the weight is **made up** of neutrons.

19. Запомните значения слова matter, прочитайте и переведите на русский язык следующие предложения.

Matter	**matter** n – материя, вещество; дело, вопрос **matter** v – иметь значение **as a matter of fact** - в действительности **no matter** (how, when, of what и т.д.) - (от того как, когда, из чего... и т.д.) **it doesn't matter** - не имеет значения

1. **Matter** is constantly undergoing changes. 2. The concept of **matter** is intuitive and yet it is somewhat difficult for definition. 3. **As a matter of fact** Robert Brown observed the movement of small solid particles in liquid quite unexpectedly. 4. Temperature is an intensive property; **it doesn't matter** how much substance is present. 5. Synthetic rubbers are a **matter** of considerable discussion at the present time. 6. No **matter** how prepared, the composition of a substance is always definite. 7. The primary consideration controlling the choice of material of construction is, of course, the **matter** of cost. 8. As a **matter** of fact the first discovery of isotopes was made by means of radioactive analysis. 9. Optics is concerned with the application of light energy to the behaviour of **matter.** 10. Chemical reactions, being a **matter** of electri-

cal movement of the atom's electrons, are often easier to measure by amount of heat absorbed or evolved. 11. There is a tendency for **matter** to achieve maximum stability.

20. Запомнив значения слов, прочитайте и переведите на русский язык следующие предложения.

Means	**means** *n* — способ, средство **mean (meant)** *v* — означать **mean** a — средний, средней величины **by means of** *prep* — при помощи **by no means** — никоим образом **by all means** — во что бы то ни стало

1. The material was by no **means** perfect, and the results obtained were rather irregular. 2. Speeds are obtained partly by electrical **means**. 3. This device is used as a **means** of regulating the amount of gas. 4. It is a **means** for producing a chemical reaction. 5. The solubility of a substance **means** the amount of that substance which will dissolve in a specified solvent. 6. The molecular formulas of compounds are determined by chemical **means.** 7. The distillation may be carried out simply in a retort or in a distilling flask connected through a condenser to a cooled receiver, often cooled by **means** of a freezing mixture in an ice vessel. 8. For our experiment we must find the **means** of several temperature measurements by all **means.** 9. This **means** that it is possible to identify both quantitatively and qualitatively the particular atoms and molecules because of the wavelength of radiation they selectively absorb or emit. 10. It is necessary to remember that molecules possess kinetic energy which **means** that they are in constant motion.

21. Запомните значения следующих слов, прочитайте и переведите на русский язык предложения.

Number	**number** n — число; номер **number** v — насчитывать, составлять **a number of** – ряд, некоторое количество **quite a number of** – целый ряд, много **a large number of** – большое число, много **a great number of** – большое количество, много **a fair number of** – достаточное количество, целый ряд

1. The atoms of sodium and chlorine have each their **number of** electrons. 2. **A number of** conditions must be fulfilled simultaneously in this operation. 3. The surface of water loses quite **a number of** heat in autumn. 4. The simplest formula of a compound expresses the ratio of the **numbers** of

the separate atoms contained in the molecule of a compound. 5. The **number** of protons determines the atomic **number.** 6. The problem is dealt with in the most profound way in quite a **number** of articles. 7. The **number** of scientists taking part in the conference was very great. 8. A **number** of scientists have confirmed this suggestion. 9. Aromatic compounds give rise to a great **number** of very characteristic bands. 10. Quite a **number** of reports deal with the polarization of light. 11. The total **number** of particles of both kinds in the nucleus is given by the rough atomic weight and the **number** of protons can be found by subtracting the atomic number from the atomic weight. 12. The nuclei of atoms of all substances (except for hydrogen) contain a **number** of protons.

22. Запомните значения слова once, прочитайте и переведите на русский язык следующие предложения.

Once	**once** *adv* — один раз, однажды **once** *cj* — как только, раз уж, после того как **at once** — тотчас же, сразу же, немедленно **once more** — еще раз

1. Once the work is started it will not be difficult to see when we shall be able to finish it. 2. **Once** we are here, we shall do it at once. 3. They performed that experiment only **once** as they had not enough materials. 4. **Once** the heat has been released from the nuclear fuel in the reactor it is transferred to the reactor coolant. 5. **Once** the structure has been determined the organic chemist attempts to synthesize the substance to make it available at low cost and in large quantities.

23. Запомните значения слова one, прочитайте и переведите на русский язык следующие предложения.

One	**one** – один, одна, одно (числительные) **one another** — друг друга **one by one —** друг за другом **on the one hand —** с одной стороны

1. An elementary substance is the **one** which consists of only **one** kind of atoms. 2. **One** of the outstanding developments in industrial chemistry is the large-scale production of methyl alcohol from carbon monoxide and hydrogen using a zinc oxide or chromium oxide mixture as a catalyst. 3. Observing the arrangement of atoms in a solid, **one** can better understand its properties. 4. **One** should take into account that sulphuric acid has a great affinity for water with which it unites with great evolution of heat. 5. The synthesis of ammonia from purified hydrogen and nitrogen is **one** of the large chemical industries of the world. 6. **One** of the ways of obtaining oxygen is to decom-

pose water by the electric current. 7. It was known that elements could unite with **one** another in more than **one** proportion but **one** should know that Dalton was the first to discover a simple relation between the different proportions in which the elements combine. 8. The purpose of quantitative analysis is to determine the relative quantity of **one** or more constituents of a compound or a mixture. 9. An empirical formula is **one** in which the simplest ratios of the elements in a compound are determined from the weight percentages provided by analysis. 10. One other important aspect of the mole concept hypothesized by Avogadro and proved experimentally, is the fact that **one** mole of any gas at 0°C and the pressure of **one** atmosphere occupies 22.4 liters of volume. 11. Many methods of preparing silicon are now in use, **one** of them is to heat silicon oxide with magnesium. 12. Red phosphorus is less chemically active than the yellow **one.** 13. **One** of the important problems is to obtain water sufficiently pure to meet our needs. 14. **One** can prove in several ways that air is not a chemical compound but a mixture of nitrogen and oxygen with small amounts of other gases. 15. It thus happens that certain mineral fuels might equally well be classified as coals and lignites and it is difficult to define where the **one** ends and the other begins.

24. Запомните значения следующих слов, прочитайте и переведите на русский язык предложения.

Only	**only** *adv* – только **the only** *a* – единственный **not only … but (also)** *cj* – не только …, но и

1. It is possible to get the necessary effect **only** by increasing the temperature. 2. Under these conditions temperature is the **only** deciding factor. 3. Since U^{235} is the **only** fissionable material which is naturally available it forms the basis for all nuclear reactor fuel. 4. It has been stated that the temperature coefficients of thermal conductivity are known with accuracy **only** for water among liquids. 5. The quality of a polymer depends not **only** on the components of its giant molecule, but on its structure as well. 6. Marie Curie investigated all other known elements to find out whether any were radioactive and discovered the fact that thorium proved to be the **only** other one. 7. In a ton of pitchblende ore was contained **only** 1/5 g *of* radium. 8. There are eight columns, or groups, and 10 rows (7 periods) in the periodic table, and hydrogen is separately classified as the **only** element in the first period. 9. Mendeleyev not **only** suggested new elements but also predicted their chemical properties. 10. The only exception to all elements is hydrogen whose nucleus contains but one proton.

25. Запомните значения слова other, *прочитайте и переведите на русский язык следующие предложения.*

Other	**other (another)** *a* – дгугой **other than** – кроме **each other, one another** — друг друга **on the other hand —** с другой стороны **otherwise** *adr* — в противном случае, или же; иначе

1. It was found that substances which seemed under particular conditions to be without action on each **other,** reacted owing to the addition of a catalyst, even with great readiness. 2. On the **other** hand the formation of aqueous ions from a solid salt is the process that frequently takes place very readily. 3. By use of a proper catalyst the effect of a reaction that **otherwise** is very slow becomes quite evident. 4. On the **other** hand the greater the number of atoms in a molecule, the greater the number of isomers possible. 5. The discussion of matter often involves the concept of energy and energy values or, in **other** words, units of energy. 6. Ionium, thorium and radiothorium are isotopes, that is, they are isotopic with one **another** and mesothorium is an isotope of radium. 7. In a solution the molecules of each substance are uniformly distributed with respect to each **other;** or, in **other** words, any part of a solution lias exactly the same composition as any **other** part, provided the temperature of all parts is the same.

26. Прочитайте и переведите на русский язык следующие предложения, обращая внимание на значения производных от глагола place.

Place *(v)*	помещать
replace *(v)*	замещать
displace *(v)*	вытеснять, замещать

1. We **place** the sodium chloride in the flask and add sulphuric acid through the funnel. 2. The hydrogen chloride gas **displaces** air from the bottle. 3. A metal **replaces** hydrogen in an acid. 4. If we mix metallic zinc with dilute hydrochloric acid, zinc **replaces** the hydrogen in the hydrogen chloride.

27. Запомните значения следующих слов и переведите на русский язык предложения.

Point	**point** *n* — пункт; стадия; суть; дело, вопрос; точка **point (to)** *v* — указывать (на) **the point is —** дело в том, что **view point —** точка зрения **point of view —** точка зрения **standpoint —** точка зрения **at this point —** здесь, на этой стадии **in point —** относящийся к данному вопросу **the point in question —** рассматриваемый вопрос **the starting point —** начало, исходный материал (сырье)

1. The **point** is that when a particular isotope has an unstable neutron-to-proton ratio the nucleus is in the process of decay and the phenomenon of radioactivity is observed. 2. Nuclear forces largely depend on neutron-to-proton ratios and it is at this **point** that isotopes become the **point** in question. 3. From the **point** of view of chemical resistance ebonite is better than soft rubber and it is to be used where chemical conditions are severe. 4. The Roman numeral (group VII) points to the number of electrons needed for the "octet" to be completed. 5. From the view **point** of the atomic molecular theory these phenomena should be explained in terms of molecular transformations. 6. There is another **point** in connection with the making of electrodes which does not generally receive attention. 7. The boiling **point** of water is 100 ^{0}C. 8. Benzene is used not only as a means of synthesizing phenol but also as a starting **point** for the production of the compounds necessary to nylon production. 9. The prefixes di (2), tri (3), tetra (4), penta (5) and so on **point** to the fact that the same alkyl group is attached to a larger carbon chain more than once. 10. The next **point** to be considered in order to prove or disprove this **point** of view is what becomes of the oxygen liberated on splitting up the carbonic oxide. 11. The terms primary (p), secondary (sec), and tertiary (tert) are applied to alcohols and **point** to the number of alkyl groups that are attached to the carbon having the hydroxyl group.

28. Запомните значения слова provide*, прочитайте и переведите на русский язык следующие предложения.*

Provide	**provide** *v*— обеспечивать, давать, снабжать **to provide for** — предусматривать **provided (that)** *cj* - при условии, что; если только **providing** *cj* - при условии, что; если только

1. Sometimes a graphical representation of data can **provide** you with a particularly valuable piece of information. 2. The volume of a given quantity of a gas varies directly with the absolute temperature, **provided** that there is no change in pressure. 3. This laboratory **provided** with up-to-date equipment solves many important chemical problems. 4. The change in volume of a given quantity of a gas is equal to 1/273 **provided** the pressure is constant.
5. When you are separating pure substance from a mixture you must **provide** for possible mistakes. 6. By then it is hoped that atomic energy will **provide** up to two million kilowatts, one-twentieth of the 40 million kilowatts which will then be produced. 7. As an outstanding advantage, polyesters **provide** a good combination of mechanical and electrical properties at relatively low cost. 8. Tap holes are **provided** in the furnace to remove iron and slag from the furnace as liquids. 9. **Provided** equal spaces are travelled by an object in equal intervals of time, the motion is uniform. 10. **Provided** we use the necessary instruments, the measurement will always be correct. 11. Automation **provided** the control of not only individual machines but also of whole factories.

29. Запомните значения слова question, прочитайте и переведите на русский язык следующие предложения.

Question	**question** *n* — вопрос, проблема **question** *v* — сомневаться, ставить под вопрос **in question** — рассматриваемый **out of question** — вне сомнения **beyond question** — вне сомнения **the question is** — вопрос в том

1. The result in **question** was obtained when we used solutions of single sugars and not mixtures whereas in the food industries it is usual to make use of mixtures. 2. We could not but **question** whether such chain nitrogen compounds contain single nitrogen-nitrogen linkages. 3. A rather theoretical **question may** be raised as to whether or not this method is more valid for pressures under 1 atm. 4. The fact that the proportion of oxygen to nitrogen in atmospheric air is not constant is beyond **question** now. 5. The fact that the atomic weight of an element is unaffected by chemical changes is not **questioned** any longer. 6. The **question** is whether there is any way of increasing the number of swiftly moving molecules to assist the process of evaporation. 7. The **question** is whether a given substance is a mixture or a true chemical compound. 8. The fact that gamma rays are the most penetrating of the three rays, going through relatively thick layers of metals and other materials of low atomic weight is beyond **question.** 9. It is out of **question** now that various changes are constantly taking place in all substances which surround us.

30. Запомните значения следующих слов, прочитайте и переведите предложения.

Rather than	а не
rather	довольно-таки
rather ... than	скорее ... чем

1. The work done is **rather** experimental **than** theoretical. 2. It is much better to use liquid hydrogen **rather than** compressed gas. 3. This theory is **rather** difficult for understanding. 4. The measurement of this experiment is **rather** inconvenient. 5. The experiments are considered to be **rather** difficult.

31. Запомните значения слова refer, *прочитайте и переведите на русский язык следующие предложения.*

Refer to *(v)*	ссылаться на что-л.
be referred to as *(v)*	называться, рассматриваться как

1. The effect of continual movement of small solid particles suspended in a liquid is referred to as Brownian movement. 2. His discovery is referred to in every text-book on physics. 3. This phenomenon is referred to as pressure exerted by gas. 4. The results of their experiments were referred to at the conference. 5. The theory referred to above deals with the nature of gases. 6. This engine is usually referred to as internal combustion engine. 7. Reference was made to the introduction of a new type of polymeric substance.

32. Запомните значения слова regard, *прочитайте и переведите на русский язык следующие предложения.*

Regard *(v)*	считать, рассматривать **in (with) regard to, regarding** – относительно **regardless** – независимо

1. The present position **with regard to** symbols is not very satisfactory. 2. Hydrogen passes through the solution without change **regardless** of the temperature. 3. Nitrogen may be **regarded** as a diluent of the atmosphere. 4. Any calculations **regarding** the number of electrons are made by means of a computer.

33. Запомните значения слова result, *прочитайте и переведите на русский язык следующие предложения.*

Result	**result** *n* — результат **result** *v* — получаться в результате **to result in** — приводить к (чему-л.) **to result from** — получаться вследствие (чего-л.) **resulting** — получающийся в результате **as a result** — в результате

1. Light is a form of energy and it must therefore **result** from the transformation of some other source of energy. 2. A chemical equation uses formulas to state what substances react and the products that finally **result.**
3. The **result** of all experiments must be recorded in a special note-book at the time the observations are made. 4. The actual chemical structure of the units from which a polymer is built has a primary effect on the properties of the **resulting** materials. 5. As a **result** of these collisions new elements are formed which may be radioactive for a time. 6. The combination of carbon and silicon with each other or with nitrogen and oxygen often **results in** network bonding so that huge crystals are formed rather than molecules, and typical examples are diamond and quartz. 7. A decrease in weight of the product **resulted** may be the **result** of the loss of some invisible gas. 8. As an illustration of bonding that **results in** monomolecular structures consider the table salt NaCl (sodium chloride). 9. A physical change may **result in** a more or less temporary alteration of the properties of a substance, but no change in composition **results from** it. 10. Explosions resulting from the combustion of finely divided carbonaceous materials always **result in** the formation of some carbon monoxide. 11. A chemical bond is a union between atoms **resulting in** a structure having greater stability and lower energy than the isolated atoms.

34. Запомните значения слова since, *прочитайте и переведите на русский язык следующие предложения.*

Since	**since** *cj* **—** 1) так как, поскольку 2) с тех пор как
	prep — с, после
	adv **—** с тех пор, тому назад
	since then – с того времени

1. Many thousands of years have passed **since** man began to use metals. 2. **Since** the hydrogen ion is composed of one proton the terms hydrogen ion and proton are synonymous. 3. As knowledge of the atom's structure increased **since** Bohr's original theory it was discovered that each energy level is subdivided. 4. The unit of measure for frequency is seconds **since** time is the only unit of measure. 5. **Since** it is necessary to carry out evaporations at several stages of the analysis these hydrolysis reactions become of importance. 6. Many other discoveries have been made **since** radioactivity was discovered. 7. Oxygen has been known **since** the 18th century. 8. Each proton must be balanced by an electron **since** their charges are equal and opposite. 9. Numerous practical applications for the determination of extremely weak acids have been reported **since** their work. 10. Copper is the metal commonly used as a conductor **since** it combines high conductivity with comparatively low cost. 11. Although sulphuric acid has been used as co-reactant with nitric acid to effect (осуществлять) the nitration of organic compounds it is only **since** about 1940 that the true nature of such mixed acid combinations has

been generally recognized. 12. The atomic weight is the sum of the protons and the neutrons **since** for all practical purposes the weight of electrons is not taken into account. 13. **Since** the ratio of the solute and the solvent can be varied, a solution is not a chemical compound. 14**. Since** solutions are mixtures, the solute and solvent components can be separated by simple physical means of evaporating the part that has the lower boiling point. 15. **Since** a little piece of salt has been examined under a microsope, it was established that it consisted of tiny cubes. 16. Many experiments with different solids were carried out in Middle Ages, **since then** a great many experimental methods have been developed. 17. Radioactivity is a natural process that has been investigated **since** the end of the last century.

35. Прочитайте и переведите на русский язык следующие предложения, обращая внимание на словосочетание с take.

Take	**take** *v* — брать, взять; занимать **it takes** — требуется **to take part** — участвовать **to take place** — происходить **to take care —** остерегаться, быть осторожным **to take fire** — загораться, воспламеняться **to take advantage of** — воспользоваться (чем-л.) **to take into consideration –** принимать во внимание, учитывать **to take into account -** принимать во внимание, учитывать **to take account of -** принимать во внимание, учитывать

1. It takes 8 minutes for the rays of the Sun to reach the Earth. 2. One should **take** care not to handle hydrogen sulphide because it is very poisonous. 3. The lowest temperature at which a substance **takes** fire is called its kindling temperature. 4. The most rapid and simplest way for chemical changes to **take** place is usually to dissolve the substances. 5. It **takes** our Earth 365 days to revolve around the Sun. 6. Advantage must be **taken** of special properties of germanium. 7. Let us **take** a vessel with water and place it in a freezing mixture of ice and snow. 8. As radioisotopes can kill living cells, great care must be **taken** in their use. 9. Account must be **taken** of the heat resulting from overcoming friction. 10. The process of fusion **takes** place inside the Sun under enormous pressures and with temperatures of the order of twenty million degrees. 11. We define an atom as the smallest particle of an element which can **take** part in a chemical change. 12. We must always **take** into consideration the amount of force applied. 13. One should **take** into account that X-ray and radioactivity are very dangerous in great amounts. 14.

It is out of question that various changes are constantly **taking** place in all substances which surround us.

36. Запомните значения следующих слов, прочитайте и переведите на русский язык предложения.

Term	**term** *n* — термин, условие, срок, семестр **term** *v* — называть **in terms of** – при помощи, в виде, посредством; языком

1. The proper use of chemical **terms** is essential for your report. 2. The word **term** may have tens of meanings. 3. These examples are presented **in terms of** organic chemistry. 4. Non-metallic oxides are **termed** acid anhydrides. 5. The second **term** begins in February. 6. Your **terms** are unacceptable for me. 7. The amount of heat is measured in **terms** of calories (cal) and kilocalories (kcal). 8. The **term** absolute temperature —273.16° was introduced because according to present experimental data it is the lowest possible temperature. 9. The smallest part of an element which can take part in a chemical reaction has been **termed** an atom.

37. Запомните значения слова time, *прочитайте и переведите на русский язык следующие предложения.*

Time	время, период, раз **…times…** — …умноженный на… **time and again —** неоднократно **at times… —**иногда

1. Having spent some **time** trying to complete the experiment he failed at it. 2. This **time** we shall be able to improve the results. 3. **Time and again** he tried to prepare a new mixture. 4. **At times** the researchers were able "to look" inside a very tiny crystal by means of X-rays. 5. 5 **times** 7 will be thirty-five.

38. Запомните значения слова that, *прочитайте и переведите на русский язык следующие предложения.*

That	тот, та, то что, чтобы, который **it is...that** — именно, только **that is —** то есть **that is why —** вот почему **that is to say —** то есть, следовательно **that is how —** вот как **so that —** так чтобы, так что

1. The acids, bases and salts have the property to conduct an electric current and **that** is why they are called electrolytes. 2. The reaction opposite to **that** of oxidation is reduction. 3. It is only with gold and platinum that sulphur

does not unite directly. 4. It is important to note **that** in the atom there is more empty space than there is solid material. 5. **That** water is a compound was proved at the end of the 18th century. 6. It is precisely chromatography **that** has demonstrated clearly **that** numerous inorganic salts are soluble in organic liquids. 7. One must remember **that** molecules possess kinetic energy, which means **that** they are in constant motion. 8. **That** this system is simple and efficient is generally recognized. 9. None of the method of the past can be compared in simplicity and efficiency to **that** of our days. 10. It was not until 1936 that physicists felt **that** they had arrived at a satisfactory theory of what is contained within the nucleus. 11. It is only under high oxygen pressure and a higher temperature **that** sodium absorbs sufficient oxygen to give superoxide NaO_2. 12. It was in 1898 **that** the Curies obtained the new element radium whose radioactivity was several million times stronger than **that** of uranium. 13. The analysis of data **that** we obtained shows **that** cosmic space is a medium where man cannot live without special protective means. 14. The electricity produced by a chemical system may be made to perform useful work such as **that** obtained from batteries, which are common examples of electrochemical cells. 15. It was estimated **that** it would take one million molecules to make a line one millimetre long. 16. The experiments carried out with hydrogen have shown **that** the gas is inflammable and burns in air with an almost colourless flame.

39. Запомните значения следующих слов, прочитайте и переведите на русский язык предложения.

through	через
though	хотя
thorough	тщательный

1. **Though** the uses of automation are many and varied the greatest progress has been made in the chemical and allied industries. 2. A computer carries out a vast number of **thorough** calculations. 3. Receiving data about the quality of the product **through** various operations of a quality sensor the computer instructs the actuators to alter variables in the process.

40. Запомните значения слова until, *прочитайте и переведите на русский язык следующие предложения.*

Until	**until** *cj*—до тех пор пока... не
	until *prep* — до

1. One should take great care never to light a supply of hydrogen **until** it is known to be free of air. 2. **Until** recently the technical uses of selenium and tellurium have been of little importance. 3. Phosphorus does not ignite in the air **until** it is heated to a temperature of 240°. 4. Salt formation in solvents will not take place **until** the base has a higher affinity for proton than the solvent has. 5. **Until** the end of the nineteenth century an atom was considered a "simple, solid, hard, impenetrable particle". 6. A weighed bulb at the bottom

of the hydrometric vessel causes it to sink **until** it displaces a volume of liquid that has an equal weight. 7. **Until** recently the Periodic Table showed four vacant places: numbers 43, 61, 85, 87. 8. Reactions that have products interacting in such a way as to reform the original reactants **until** a balance is reached are called equilibrium reactions. 9. Atoms could not be "seen" **until** the twentieth century. 10. There are some elements which do not catch fire **until** they are heated. 11. It was not **until** the eighteenth century that steel began to replace wrought iron in the making of tools and weapons. 12. Although the compounds of silicon have been used for many centuries the element was not prepared **until** the beginning of the 19th century.

41. Запомните значения слова very, прочитайте и переведите на русский язык следующие предложения.

Very	**very**+ наречие (прилагат.) *adv* — очень **the very**+ существит. (порядк. числит.) *a* —(тот) самый, как раз

1. The rays of uranium became the **very** subject for Curie's research work. 2. Hydrochloric acid is one of the acids containing no oxygen at all and the **very** name of this acid shows that it is composed of hydrogen and chlorine. 3. It is **very** interesting that it was Lavoisier who called the gas discovered by Cavendish hydrogen, meaning 'water former". 4. By the beginning of the 20th century a **very** large amount of factual material concerning the preparation and properties of the important elements and the compounds was known.

42. Запомните значения слова way, прочитайте и переведите на русский язык следующие предложения.

Way	путь, способ, образ действия **way out** – выход **by way of** – в качестве, с целью **by the way** – между прочим **in no way** – никоим образом

1. **By the way**, before we go further with the discussion, we have first to learn more about the ways in which the probability of different single or complicated events can be calculated. 2. These reactions differ in many **ways**. 3. His **way** to the science was very difficult. 4. Water **in no way** should be mixed with this compound. 5. They investigated chemical properties of these substances **by way of** experimenting.

43. Запомните значения слова yield, прочитайте и переведите на русский язык следующие предложения.

Yield *(v)*	1) давать, производить; 2) продукт, выход

1. We know that thermonuclear fusion reactions can **yield** high temperatures. 2. Research on this matter may **yield** information useful to the construction of such a device. 3. The discovery of X-rays has **yielded** certain branches of medicine, radiology, radiotherapy and crystallography. 4. The experiment **yielded** no results. 5. The **yield** in this branch of industry contributed much to national economy.

Лексико-грамматический блок

Грамматические упражнения

1. *Прочитайте и изучите следующие примеры.*

Простое настоящее время (Simple Present)

1. **I study** at the University.	**Я** учусь в университете.
He studies at the University.	**Он** учится в университете.
2. **Do** you **study** at the University?	**Вы** учитесь в университете?
Yes, **I do. I study** at the University.	**Да. Я** учусь в университете.
Does she **study** at the University?	**Она** учится в университете?
Yes, she **does.** She studies at the University.	**Да. Она** учится в университете.
3. They **do not (don't) study** at school.	**Они** не учатся в школе.
They **study** at the University.	**Они** учатся в университете.

Простое прошедшее время (Simple Past)

1.We **worked** at a plant last year.	Мы работали на заводе в прошлом году.
She **studied** at school last year.	Она училась в школе в прошлом году.
2.**Did** you **work** at a plant last year? Yes, **I did**.	Вы работали на заводе в прошлом году? Да.
Did he **work** at a plant last year? Yes, **he did.**	Он работал на заводе в прошлом году? Да.
3.He **did not (didn't) work** at the plant last year.	Он не работал на заводе в прошлом году.
We **did not (didn't) study** at the University last year.	Мы не учились в университете в прошлом году.

Простое будущее время (Simple Future)

1. We **shall have** two lectures tomorrow.	Завтра у нас будут две лекции.
I shall go home after lectures.	Я пойду домой после лекций.
He **will study** chemistry at the University.	Он будет изучать химию в университете.
2. **Shall** we **have** two lectures tomorrow?	У нас будут две лекции завтра?
3. Yes, **we shall**. We **shall have** two lectures tomorrow.	Да. У нас будут две лекции завтра.
4. **Will** they **have** lectures tomorrow? No, they **will not**. They will have lectures on Monday.	У них будут лекции завтра? Нет. У них будут лекции в понедельник.

2. *Поставьте следующие предложения в вопросительной форме и дайте ответ.*

1.He usually carries out the experiments in the laboratory of inorganic chemistry. 2. She studied at school last year. 3. He will study English at the Institute. 4. I get up at 7 o'clock. It takes me 45 minutes to get to the Institute.

5. I lived far from the Institute last year. 6. He will not go to the theatre tomorrow. 7. They went to the theatre yesterday. 8. We go to the cinema on Sundays. 9. They study in the reading-hall every day. 10. We shall finish the experiment tomorrow. 11. The students passed all the exams in January.

3. Прочитайте и переведите следующие предложения.

1. He works as an engineer at a plant. 2. He studied at the evening department last year. 3. She will read for her examinations at the library tomorrow. 4. The students are at the lecture now. 5. He gets up at 7 o'clock. 6. The lecture lasted for two hours yesterday. 7. He worked at a plant last year. 8. She will be ready for a walk in half an hour. 9. This country has achieved success in the development of chemical industry.

4. Выберите правильную форму глагола, прочитайте и переведите следующие предложения.

1. We (carry on, are carrying on) experiments every week. 2. We usually (work, have worked) in the laboratory of inorganic chemistry. 3. (Have, do) you study the method of preparing hydrogen in the laboratory? 4. The hydrogen chloride gas (will dissolve, will have dissolved, will be dissolving) in water as it displaces the air from the bottle. 5. The researchers (will complete, will have completed) the experimental part of their investigation in a week.

5. Прочитайте и изучите следующие примеры.

Настоящее продолженное время (Present Continuous)

1. I **am writing** now.	Я пишу сейчас.
He (she, it) **is** writing now.	Он (она) пишет сейчас.
We (you, they) **are** writing now.	Мы (вы, они) пишем сейчас.
2. He **is not writing** now.	Он не пишет сейчас.
They **are not** writing now.	Они не пишут сейчас.
3. **Is** he **writing** now?	Пишет ли он сейчас?
Are they **writing** now?	Пишут ли они сейчас?

Прошедшее продолженное время (Past Continuous)

1. I (he, she, it) **was** We (you, they) **were**	**writing** a test for an hour yesterday.	Я (она, он) писал(а) контрольную работу в течение часа вчера.
2. She **was not writing**... We **were not writing**...		Она (мы и т.д.) не писала...
3. **Was** she **writing**...? **Were** you **writing**...?		Писала ли она (мы, вы и т.д.)...?

Будущее продолженное время (Future Continuous)

1. We **shall be** They **will be**	**writing** the test from 9 to 10 a.m.	Мы (Они) будем (будут) писать контрольную работу с 9 до 10 часов утра завтра.
2. **Will** they **be writing**...?		Будут ли они писать...?
3. We **shall not be writing**...		Мы не будем писать...

6. Переведите следующие предложения.

1. The students were writing down all the data during their experiment. 2. Water boils at 100°C. The water in the tube is boiling. 3. The students were carrying out the experiment from 5 to 7 o'clock. 4. Our plants and factories are producing about fifty kinds of synthetic rubber now. 5. The students are listening to the lecturer. 6. My friend is preparing for the seminar in the reading-hall. 7. We shall be translating the article when he comes. 8. He will be reading in the library at that time tomorrow.

7. Прочитайте и запомните следующие примеры.

Настоящее совершенное время (Present Perfect)

1. She **has read** this book.	Она прочитала эту книгу.
2. She **has** never **been** to Moscow.	Она никогда не была в Москве.
3. We **have** often **worked** in this laboratory.	Мы часто работали в этой лаборатории.
4. I **have not seen** him since he graduated from our Institute.	Я не видел его с тех пор, как он окончил наш институт.
5. We **have translated** many articles lately.	Мы перевели много статей за последнее время.

Прошедшее совершенное время (Past Perfect)

1. He **had completed** the experiment by 5 o'clock (5 p.m.) yesterday.	Он завершил эксперимент к 5 часам вечера вчера.
2. They **had** already **completed** the experiment when he came in.	Они уже завершили эксперимент, когда он вошел.
3. She said that she **had taken part** in the conference.	Она сказала, что она принимала участие в конференции.
4. **Had** he **completed** the experiment by 5 p.m. yesterday? Yes, he had. No, he had not (hadn't).	Он закончил эксперимент к 5 часам вечера вчера? Да. Нет.
5. He **had not (hadn't) completed** the experiment by 5 p.m. yesterday.	Он не закончил эксперимент к 5 часам вечера вчера.

Будущее совершенное время (Future Perfect)

1. We **shall have completed** the experiment by the end of the month.	Мы уже завершим эксперимент к концу месяца.
2. They **will have passed** the exams by the end of January.	Они уже сдадут экзамены к концу января
3. Shall we **have completed** the experiment by the end of the week? Yes, we shall. No, we shall not.	Мы уже закончим эксперимент к концу недели? Да. Нет.

8. Прочитайте и переведите следующие предложения.

1. They have already used new technology in their work. 2. The technician will have installed the new equipment in our laboratory by the beginning of the new year. 3. Rapid changes have taken place in science and technology these few years. 4. They have never been late for their classes. 5. He had sent the telegram before they came.

9. Прочитайте и запомните следующие примеры, обращая внимание на образование страдательного залога (Passive Voice).

Настоящее время

Present Simple	am, is, are	+ Participle II
Present Continuous	am, is, are + being	
Present Perfect	have, has + been	

Прошедшее время

Past Simple	was, were	+ Participle II
Past Continuous	was, were + being	
Past Perfect	had + been	

Будущее время

Future Simple	shall, will be	+ Participle II
Future Perfect	shall, will + have been	

10. Сравните и запомните следующие Видовременные формы английского глагола в страдательном залоге и соответствие русских временных форм временным формам английского глагола.

Времена страдательного русского глагола	Времена страдательного залога английского глагола	Предложение на русском языке	Соответствующее предложение на английском языке
НАСТОЯЩЕЕ время	Present Simple	Кинетическим методом выведено выражение для … (Кинетический метод <u>используется</u> для вывода выражения …)	A kinetic method <u>is used</u> to derive the general expression for…
	Present Continuous	Кинетический метод <u>используется</u> для …(сейчас)	A kinetic method <u>is being used</u> to derive …
	Present	Кинетический	A kinetic method <u>has been</u>

	Perfect	метод использовали	used to derive the general expression for …
ПРОШЕДШЕЕ время	Past Simple	Кинетический метод использовался … (Кинетическим методом было выведено …)	A kinetic method was used to derive the general expression for …
	Past Continuous	Кинетический метод использовался … (в определенный период в прошлом)	A kinetic method was being used …
	Past Perfect	Кинетический метод был использован для вывода … (к определенному моменту в прошлом)	A kinetic method had been used to derive …
БУДУЩЕЕ время	Future Simple	Кинетический метод будет использован ….	A kinetic method will be used to derive …
	Future Continuous	Кинетический метод будет использоваться … (в определенный период в будущем)	A kinetic method will be being used…

11. Прочитайте и запомните следующие примеры использования и перевода страдательных конструкций.

1. The material is subjected to chemical treatment.	Материал *подвергают* химической обработке. Материал *подвергается* химической обработке.
2. All of these requirements can be satisfied.	Все эти требования могут быть удовлетворены.
3. Toxic reagents should be handled with care.	С токсичными реагентами следует обращаться с осторожностью. (действующее лицо - неважно)
4. An instruction can be found on page 20.	Инструкцию можно найти на стр.20. (действующее лицо – люди вообще)
5. I was fined for speeding.	Я был оштрафован за превышение скорости. Меня оштрафовали за превышение

	скорости.
6. Some additional information was reported by an investigator.	Исследователь привел дополнительную информацию. Дополнительная информация была приведена исследователем.
7. Living cells are damaged by radiation.	Радиация наносит вред живым клеткам.
8. I was shown some papers on polymerization.	Мне показали некоторые статьи по полимеризации.
9. These terms were agreed upon.	Договорились на этих условиях.
10. I am often laughed at.	Надо мной часто смеются.
11. Steps should be taken to decrease the reaction rate.	Следует принять меры, чтобы уменьшить скорость реакции.
12. These devices were shown preference to because of their simplicity.	Этим устройствам было оказано предпочтение из-за их простоты.

12.Переведите предложения, обращая внимание на формы страдательного залога, выделенные курсивом.

а) 1.Oxidation *is accompanied* by an algebraic increase in valence. 2.In the first year we *are taught* chemistry, structure of matter, higher mathematics, etc. We *are* also *given* laboratory works to do. 3.The valence or combining capacity of an atom *is determined* by the number of electrons it gains, loses or shares in chemical combinations of atoms of other elements.

б) 1.The Law of Constant Composition *was* first definitely *stated* by John Dalton in 1804. 2.All the instruments *were looked* at with great interest. 3.By the end of the eighteenth century the terms "element" and "compound" *were* generally *accepted.*

в) 1.Is this true that this problem *will be investigated* in our laboratory? 2.His scientific paper *will be presented* at the conference and we *shall be invited* to the discussion of it. 3. All the data *will be analysed* by the experimenter himself.

13. Переведите следующие предложения на русский язык, обращая внимание на способы передачи английского страдательного залога.

1. The money has been transferred to my bank account.
2. The accident has already been reported.
3. The machines were manufactured **by** the Boron Group in Germany.
4. The most dangerous nuclear waste **can be** turned into glass.
5. Optical constants are studied **by** (using) the multiple-scattering method.
6. The difficulty is removed **by** simplifying the equation.

7. Temperature structure coefficients were measured **with** temperature sensors.
8. The valence band technique **should** be used to calculate the free valence.
9. Particular **attention was given** to the composition and degree of homogeneity of the crystals.
10. The investigation was carried out at room temperature.
11. **It** has been shown that the spectrometer is designed for the far infrared.
12. **It** is assumed that the resistance region is negative.
13. **It** was found that the models provided a very good fit to the experimental data.
14. **It** is believed that the results can be explained by the solid state theory.
15. Collision processes **must** be studied in ionized gases.
16. This problem **may** be closely related to photosynthesis in plants.
17. These changes **will** be well exhibited during the process.
18. Some problems **are being discussed** by researchers in the seminar.
19. Some comments **were made** on Smith’s monograph on mechanism of protein synthesis.
20. A new interpretation of biosynthetic processes will be put forward at the Sympoium “Science and Technology”.
21. Simultaneous translation of papers is generally provided at international conferences.
22. The congress was held in Geneva.

14. Переведите следующие предложения, обращая внимание на падеж дополнения.

1. Amplitude variations are **neglected** by such systems.
2. Polychlorinated biphenyls are **forbidden** as plasticizers because of their environmental hazards.
3. The homogeneous conversion in liquid ammonium should be **discussed**.
4. The first appearance of living species was **preceded** by the gradual development of a chemical environment.
5. These errors **can be avoided** by using such techniques.
6. A new air-cooled transformer **has been ordered** by <u>customers</u>.
7. Dating rocks **can be assisted** by radiometric determinations.

15.Переведите следующие предложения , обращая внимание на глаголы с предложным дополнением.

1. A semiconductor **can be subjected to** heating to increase the number of free electrons.
2. The particle **is departed from** its path by the gravitational field of Jupiter.
3. The process should **be done away** with as uneconomic.

4. The causes of the problem cannot be **arrived at** by the chemists and engineers.
5. The repulsion between molecules at small intermolecular distances **is insisted on** by physists.
6. Considerations of phase equilibria for understanding of some mass-trasfer process **are insisted on**.
7. These features have already been **referred to** in Chapter 4.
8. A computer – controlled device **can be relied on**.
9. Some important experimental findings of neurophysiologists **have been much spoken of** in recent years.

16. Переведите следующие предложения, не забывая при переводе о месте предлога.

1. The nonuniform spatial distribution of the laser beam must be **accounted for**.
2. Computer design problems are **dealt with** by numerous engineers.
3. The lower density of cold-worked metals **can be brought about** by microcrack formation.
4. This disagreement **is referred to** the oversimplified method.
5. The sample **was subjected to** a laser pulse.
6. Many details of the global system of planets **will be touched upon** later.
7. Modifications at the power stations **are being commented** on now.
8. This date will be insisted on.
9. The results of the experiment can be relied upon.
10. The matter was referred to.

17. Переведите следующие предложения с английским глаголами в страдательном залоге на русский язык.

1. The abundance of the experimental material is not followed by the corresponding achievements in theories.
2. The properties of transition metal oxides are greatly influenced by the states of orbitals.
3. Mechanical properties of the sintered material will be affected by the character of the Me-O bond.
4. The main XPS peak of the photoemission curve was succeeded by the low-intensity peak.
5. A brief outline of the method of calculation will be followed by details on the structure of crystals.

18. Перевести предложения с английского языка на русский.

1. The attention of research workers has recently been given to the field of thermally stable polymers.

2. An attempt was made to consider in general the structure of high conductive materials.
3. Much attention is now being paid to the operation conditions of the new apparatus.
4. Account should be taken of “weak” bonds in the macromolecule.
5. Advantage is to be taken of the effect of the unit structure on thermal ageing.
6. Steps were taken by Efros [4] to find quantitative relation between stabilizator concentration and the strength of fibres.
7. Special emphasis is put on (placed) mutual influence of the proteins and polysaccharides in food systems.
8. The opportunity should be taken to apply for this job.
9. Extreme care must be taken to carry out shock tube measurements.
10. A reference is made to the similarity in the order of the values of the virital coefficients.

19. Переведите следующие предложения, обращая внимание на особенности перевода страдательного залога.

1. The adsorptrion density dependence of reagent concentration is explainned by a perpendicular orientation of the aromatic ring on mica.
2. Smaller amounts of solids will be carried over into the solvent phase and severe crud accumalation in the circuit won’t take place.
3. Several ways to decrease crud formation have been proposed.
4. Suspended solids have been removed from the aqueous feed solution with sand filters.
5. The adsorption is influenced by the conditions and surface properties of the solids.
6. Amorphous fused silica with a small particle size and high surface area was chosen as the main adsorbent in order to obtain large differences in reagent concentration.
7. A technique for determination of the energetic efficiency should be followed and illustrated with experiments.
8. Modelling of the kinetics of milling was developed primarily for size reduction; presently it is considered in the time domain.
9. The material transformation in the course of milling is accounted for by just energy rather than time.
10. Some relationships of both time domain and energy domain kinetics are influenced by size reduction.
11. A number of experiments describing the intensity dependence of the efficiency of milling was followed by the common conclusions.
12. Mention has already been made that the data obtained are essentially effected by the adopted parameters of the actual intensity of treatment.

13. An empirical approach to modelling has been made because of the complexity of physical processes accompanied by chemical conversions.
14. An attempt is made to reduce the temperature factor of the magnetic permeance.
15. An advantage has been taken of classical chemical kinetics to describe the process quantitatively with the substitution of time by energy.
16. Special attention has been called to kinetic simulation of methane oxidation to treat data of pilot experiments.
17. Care should be taken not to increase temperature above 500 C as significant deposition of the target products can take place.
18. The calculated oxygen concentration at which maximal yield of methanol is attained coincides well with our experimental value.
19. It should be noted that due to the inhibiting effect of oxygen concentration on the rate of reaction calculations show a very strong increase in a polymerization degree at isothermal conditions.
20. Analysis of non-linear processes during the oxidative conversion of methane to methanol has been followed by description of two stable chain-branched regimes.

20. Перевести предложения с английского языка на русский.

1. The behavior of metals is affected by the changes in t^o.
2. Many materials now commonly used were not even thought of thirty years age.
3. Analysis is naturally followed by synthesis.
4. A mechanical method was substituted for by an electric one.
5. The charge of an atom is not affected by the number of neutrons present but depended on the balance between electron and protons.
6. The region surrounding a magnet, in with appreciable magnetic forces exist field, there is a motion of electrons due to this field.
7. When the molecules of even a good insulator are acted upon by an electric field, there is a motion of electrons due to this field.
8. Chemical methods of purifying water are given much attention to by our scientists.
9. When a concentrated clay suspension is allowed to settle, the clay will occupy a volume which is different from the original volume of the clay.
10. Almost all materials are affected to some extent when placed in a strong magnetic field.
11. In practice the solidification of pure metals is influenced to a great extent by what may be generally described as external conditions.
12. The solubility of phosphate in sea water is largely a function of pH, a property which is influenced by bacterial activities.
13. In gaseous reaction the equilibrium position is largely influenced by pressure.

14. The range of application of gas chromatography is wide and most substances boiling under 300°C, own be dealt with readily.
15. The purity of an organic compound may be judged by the determination of various physical constants, such as the specific gravity, crystal form, or index of reaction.

21.Поставьте глаголы, данные в скобках, в нужном времени и залоге. Переведите предложения.

1. The importance of nitrogen (to speak about). 2. The discovery of Robert Brown (to think of) as one of the greatest discoveries of his time. 3. A new method (to present) in his report. 4. The chief engineer (to send for) immediately. 5. His results may (to rely upon).

22. Прочитайте, переведите и ответьте на вопросы по модели.
Модель:

Is the mass of an atom concentrated in the nucleus?	
Yes, it is.	No, it is not.
Yes, it is concentrated in the nucleus.	No, it is not concentrated in the nucleus.

1. Is matter composed of atoms? 2. Is valence of an atom determined by the number of electrons? 3. Is reduction accompanied by an algebraic increase in valence? 4. Can the chemical properties be explained by the structure of the atom? 5. Is the activity of metals related to the size of the atom?

23. Составьте возможные варианты предложений.

This magazine	will be translated	with a lot of pictures.
Those high buildings	will be built	from a distance.
Scientific reports	was published	in our magazine.
The article	were discussed	with a lot of diagrams.
Some questions	were read	yesterday.
All these stories	were built	with great interest.
A lot of new schools	are illustrated	last year.
Some articles	are seen	by him.
All these houses	are published	very soon.

24.Переведите следующие предложения.

1. Some new laboratories are being built in our Institute. 2. She is promised immediate help. 3. The results of the experiment can be relied on. 4. This problem of nuclear magnetic resonance will be dealt with in a number of articles. 5. The book is often referred to by our teacher. 6. The terms were agreed upon. 7. These data were not spoken about. 8. The report was followed by a discussion. 9. The rate of the reaction is influenced by many factors. 10. Soon that discovery was followed by another one. 11. This method of analysis is

being gradually done away with. 12. Mention has already been made of this phenomenon. 13. The discussion is followed by brief descriptions of several radar sets. 14. The theory of viscosity will be referred to in more details later. 15. From their very nature, charged particles are influenced by electric fields.

25.Переведите следующие предложения.

1. The behavior of metals is affected by the changes in t^o. 2. Many materials now commonly used were not even thought of thirty years ago. 3. Analysis is naturally followed by synthesis. 4. A mechanical method was substituted for by an electric one. 5. The charge of an atom is not affected by the number of neutrons present but depended on the balance between electron and protons. 6. The region surrounding a magnet, in with appreciable magnetic forces exist field, there is a motion of electrons due to this field. 7. When the molecules of even a good insulator are acted upon by an electric field, there is a motion of electrons due to this field. 8. Chemical methods of purifying water are given much attention to by our scientists. 9. When a concentrated clay suspension is allowed to settle, the clay will occupy a volume which is different from the original volume of the clay. 10. Almost all materials are affected to some extent when placed in a strong magnetic field. 11. In practice the solidification of pure metals is influenced to a great extent by what may be generally described as external conditions. 12. The solubility of phosphate in sea water is largely a function of pH, a property which is influenced by bacterial activities. 13. In gaseous reaction the equilibrium position is largely influenced by pressure. 14. The range of application of gas chromatography is wide and most substances boiling under 300°C, own be dealt with readily. 15. The purity of an organic compound may be judged by the determination of various physical constants, such as the specific gravity, crystal form, or index of reaction.

26. Прочитайте и запомните следующие примеры, обращая внимание на условные союзы и перевод условных предложений.

Условные предложения (Conditional Sentences)

а)	1. If a substance conducts electricity, it will be heated.	Если вещество *проводит (будет проводить)* электричество, то оно будет нагреваться.
	2. If a metal were heated, it would melt.	*Если бы* металл *нагрели*, он *бы расплавился.*
	3. If a non-metal had been cooled, it would have become brittle.	*Если бы* неметалл *охладили*, он *бы стал* хрупким.
б)	1. Provided the temperature were high, a metal would melt.	*Если бы (при условии, что)* температура была высокая, металл *бы расплавился.*

	2. Unless non-metals had been brittle, they would have been ductile.	*Если бы* неметаллы не были хрупкими, они *были бы* ковкими.
в)	1.Were the temperature conditions normal, this substance would not melt.	*Если бы* температурные условия *были* нормальными, это вещество не *расплавилось бы.*
	2. Had the temperature been raised, we should have got a new alloy.	*Если бы* температура *была* повышена, мы *бы получили* новый сплав.

27. Прочитайте и переведите следующие предложения.

1. If the experiment is successful, the results will be accurate. 2. Provided the temperature were high, the metal would melt. 3. Unless metals had been good conductors, they wouldn't have been used in many branches of industry. 4. If non-metals hadn't borrowed electrons, they would not have combined with metals and formed salts. 5. Provided the experiment were successful, they would publish the results in a scientific journal.

28. Прочитайте следующие предложения, выбрав глагол в нужной форме; проверьте себя по ключу. Переведите предложения.

1. If they (come, will come) tomorrow, I shall meet them at the station.

2. Unless metals (lent, had lent) electrons they wouldn't have combined with non-metals and formed salts. 3. Provided we (got, have got) good results in our experiment, we should take part in the discussion. 4. If he (had known, knew) the problem better, he wouldn't have made a mistake in his experiment. 5. Unless she (were, had been) too busy tonight, she would have met with them.

29. Прочитайте, переведите следующие предложения, преобразуйте их в бессоюзные предложения в соответствии с примерами раздела в) упр. 26.

1. If he had come in time, we should have met him. 2. If I were present at the meeting tonight, I should take part at the discussion. 3. Provided the temperature were high, the substance would melt. 4. If a chemical substance were heated, it might decompose. 5. If he were more attentive at the lesson, he could translate the article well.

30. Прочитайте следующие примеры, обращая внимание на перевод глагола should.

1. I said that I **should carry out** this experiment once more.	Я сказал, что *проведу* этот эксперимент еще раз.
2. If we cooled oxygen to - 192.98°C, we **should (could, might) achieve** its	Если бы мы охладили кислород до - 192,98°C, мы *достигли бы*

boiling point.	*(смогли бы достичь)* его точки кипения.
3. If we had obtained good results in our last experiment, **we should have discussed** them at the conference.	Если бы мы получили хорошие результаты в нашем последнем эксперименте, мы *обсудили бы* их на конференции.
4. It is necessary that the work **should be done** (be done) in time.	Необходимо, *чтобы* работа *была выполнена* вовремя.
5. He suggested (insisted, ordered, etc.) that the work **should be done** (be done) in time.	Он предложил, *чтобы* работа *была выполнена* вовремя.
6. It **should be noted** (pointed out, etc.) that oxygen is widely used in industry.	*Следует отметить*, что кислород широко используется в промышленности.
7. I **should like** to repeat this experiment.	*Мне бы хотелось* повторить этот эксперимент.
8. Repeat the experiment **lest** you **should make** a mistake.	Повторите эксперимент, *чтобы не сделать* ошибку.

31. Прочитайте и переведите следующие предложения, обращая внимание на глагол should.

1. We said that we should examine the chemical composition of the given substance. 2. If I had had a dictionary, I should have translated the article.

3. It is possible that the experiment should be carried out in three days.

4. They suggested that the conference should be convened at the end of February. 5. It should be pointed out that the problem involved is of great interest. 6. I should like to take part in the discussion of this method. 7. Use the dictionary lest you should spend too much time to translate the text. 8. If we were present at the meeting, we should know better the questions discussed. 9. I said that they should investigate this substance once more.

10. He demanded that they should do it.

32. Прочитайте следующие примеры, обращая внимание на перевод глагола would.

1. He said that he would carry out this experiment once more. Он сказал, что он проведет этот эксперимент еще раз.

2. If we cooled oxygen to- 192.98°C, it would boil. Если бы мы охладили кислород до - 192.98°C, он закипел бы.

3. If they had obtained good results in their experiments, they would have discussed them at the conference. Если бы они получили хорошие результаты в своих экспериментах, они обсудили бы их на конференции.

4. At high temperature this substance would decompose. При высокой температуре это вещество разложилось бы.

5. Water would boil (water boils, water will boil) at 100°C. Вода кипит при 100°C.

33. Прочитайте и переведите следующие предложения, обращая внимание на глагол would.

1. They said that they would take into account the properties of oxygen.

2. If the reaction proceeded at the given temperature, the end product would increase. 3. According to the hypothesis concerned, the material would be a good insulator of electricity. 4. It would be an error to say that carbon alone is responsible for the difference between steel and cast iron. 5. Liquid oxygen would boil at - 192.98°C. 6. As the result of its outstanding chemical reactivity oxygen would combine with all the elements except the inert gases. 7. He pointed out that he would investigate the reactivity of the substance involved. 8. Had he not investigated this phenomenon, he would not have got such interesting results. 9. Were she present at the conference she would take part in the discussion.

34. Прочитайте следующие предложения, вставляя вместо точек глагол should или would, проверьте себя по ключу. Переведите предложения.

1. The engineer ordered that the work ... be finished. 2. He said, that he ... inform us about the conference. 3. It is necessary that they ... do it. 4. Oxygen ... form oxides with metals and non-metals. 5. It is essential that liquid oxygen ... be handled with great care. 6. Oxygen ... become a pale blue crystalline solid at a temperature of - 218.7°C. 7. It is important that all precautions ... be taken to avoid any leakage of oxygen. 8. At a temperature of - 192.98°C oxygen ... boil. 9. It ... be noted that oxygen may be prepared in a number of ways. 10. Oxygen ... support combustion.

35. Прочитайте и переведите следующие предложения, обращая внимание на глагол WOULD, SHOULD and WILL

1. As the plant is a living thing it must have food, otherwise it would die. 2. It would be impossible to me to overcome all the difficulties without this new method. 3. Most of iron isotopes have zero nuclear spin and would not have any hyperfine structure. 4. The apparatus was examined several times and it would always prove quite exact. 5. It is necessary that the substance should prossess all the qualities needed for these new conditions. 6. Good lubrication will reduce the friction. 7. We knew that we should be able to account for this phenomenon. 8. Sometimes this device will go wrong without any apparent cause.

36. Прочитайте и запомните следующие примеры.

Причастие (The Participle)

Причастие настоящего времени (Participle 1)

Действительный залог (Active Voice)

1. I spent a lot of time **mixing**, these liquids.	1. Я затратил много времени *смешивая* эти жидкости.
2. **Dripping** taps must be repaired.	2. *Протекающие* краны надо починить.

Страдательный залог (Passive Voice)

The experiment **being carried out** in our laboratory deals with the properties of inert gases.	*Проводимый* в нашей лаборатории эксперимент связан со свойствами инертных газов.

Причастие прошедшего времени (Participle II)

Действительный залог (Active Voice) отсутствует

Страдательный залог (Passive Voice)

The experimental data **obtained** proved the theory.	*Полученные* экспериментальные данные подтвердили теорию.

Причастие совершенного времени (Perfect Participle)

Действительный залог (Active Voice)

Having discussed the experimental data at the conference he decided to publish them without delay.	*Обсудив* экспериментальные данные на конференции, он решил немедленно их опубликовать.

Страдательный залог (Passive Voice)

The experimental data **having been discussed**, he decided to publish them without delay.	*После того, как* экспериментальные данные *были обсуждены,* он решил немедленно опубликовать их.

37. Прочитайте и переведите следующие предложения.

1. Experimental techniques dealing with gases were developed in the sixteenth and the seventeenth centuries. 2. Investigating the properties of gases E. Torricelli invented the mercurial barometer. 3. Having prepared everything for the laboratory work, the students began experimenting with chemicals. 4. Having considered the problem, we arrived at a definite conclusion.

38. Изучите примеры, обращая внимание на перевод while, when, if в сочетании с причастием. Прочитайте и переведите предложения.

I. **While carrying out** the experiment the student should be very careful.	1. *Проводя* эксперимент, студент должен быть очень внимателен. 2. *При проведении* эксперимента

	студент должен быть очень внимателен.
II. **When heated** up to 100°C water boils.	1. При *нагревании* до 100°C вода кипит. 2. *Когда* воду *нагревают* до 100°C, она кипит.
III. The substance can be readily recognized **if represented** by physical and chemical properties.	1. Вещество можно легко распознать, *если представлены* его физические и химические свойства. 2. Вещество можно легко распознать *при наличии* его физических и химических свойств.

1. While evacuating closed chambers Guericke demonstrated the existence of rarefied atmosphere. 2. While developing experimental techniques scientists of the sixteenth and the seventeenth centuries made an important contribution to the study of gases. 3. While developing different instruments, E. Torricelli invented the mercurial barometer. 4. Molecular properties are most easily evaluated if observed in the dilute condition of matter.

39. Переведите следующие предложения.

1. Physics is a broad science that deals primarily with phenomena involving the transformation of matter and energy. 2. The stability of the compound being formed must be considered. 3. Hydrogen is the lightest substance known. 4. Different forms of magnetic circuits can be employed depending on the material used, results desired, cost and other factors. 5. Unfortunately it is not possible to present in this book all the information obtained. 6. When freshly prepared this substance is colourless. 7. Having obtained the necessary compound we could finish our experiment. 8. Having mixed these two substances we put the mixture into a clean test-tube. 9. Rutherford's research work followed by many experiments of other scientists made a great contribution into physics. 11. Metals may be subdivided on the basis of their activities into two groups, namely those displacing and those not displacing hydrogen from acids. 12. The volumes of gases entering into or resulting from a chemical reaction may be represented by a simple ratio of small numbers.

40. Переведите следующие предложения.

1. It is possible to obtain graphically the additional information about images in spherical mirrors referred to above. 2. The positron or positive electron was discovered in 1932 by C.D. Anderson while working with cosmic rays. 3. The ten naturally radioactive elements referred to above have altogether 40 isotopes. 4. As stated before, the greater the binding energy the more stable the nucleus. 5. Having become familiar with the main laws of statics we can study the laws of dynamics. 6. Once formed bubbles rise because of the vapor

being less dense than the liquid in which it is suspended. 7. Having obtained the radical equation to be solved, let us investigate the method of solution. 8. Having described in a general way what is meant by an electric current, the next step is to introduce quantitative measures for such currents and their effects. 9. In the radioactive bodies alpha, beta, and gamma rays are emitted spontaneously, and at a rate uninfluenced by any chemical agent. 10. It is a common observation that bodies expand when heated.

41. Переведите следующие предложения.

1. It is a matter of common observation that light is refracted when passing from one medium into another. 2. As already stated the greater these factors are, the greater is the elesticity of the body. 3. As mentioned previously sodium tarnishes when exposed to air. 4. As emphasized above these elements are strongly radioactive when isolated in pure state. 5. As pointed out above heavy water has been carefully studied, new methods referred to earlier having been developed for its isolation. 6. The heat liberated causes a rise in temperature that is indicated on the thermometer. 7. Based on the laws of conservation we can formulate chemical equations with somewhat greater measure of justification. 8. The results obtained depended on a number of factors described earlier. 9. Further they have found that certain elements were transformed into other elements completely uninfluenced by measures taken. 10. The partial pressure exerted by each gas in the mixture depended on the per cent of molecules, i.e. upon the relative value of the molecular concentration of the gas. 11. The solution heated changed its colour very rapidly. 12. The first element produced in this way was the missing number 43, it being named "technetium", meaning "artificial". 13. The quantity of heat required for the changing the unit mass of a substance from the solid to liquid state without any change of temperature is called latent heat. 14. The distribution of radiation in these cases is very different from that observed for the same body when heated to a sufficient temperature to emit ordinary light.

42. Прочитайте, изучите следующие примеры, обращая внимание на перевод независимого причастного оборота.

1. **Water playing the most essential part in our lives,** it is universally needed everywhere.	*Так как (поскольку) вода играет основную роль в нашей жизни,* она требуется повсеместно.
2. **Water having evaporated from rivers and seas,** it is deposited on cooling as rain.	*После того как (когда) вода испаряется из рек и морей,* она выпадает, охлаждаясь, в виде дождя.
3. Molecules often collide with the sides of the container they are in, **the liquid taking up the shape of the container.**	Молекулы часто ударяются о стенки сосуда, в котором они находятся, *причем (при этом, а, и) жидкость принимает форму со-*

суда.

43. Прочитайте и переведите следующие предложения, обращая внимание на независимый причастный оборот, выделенный курсивом.

1. Molecules are in constant motion, *the motion becoming more rapid with the increase of temperature. 2. The temperature being raised,* the kinetic energy is increased. 3. The evaporation increases with the temperature, *other conditions being equal.* 4. *Water power being one of the best and cheapest ways of producing electricity,* it is widely utilized to drive generators which provide electric current. *5. This material being used in electronics,* its properties should be studied closely. 6. Non-metallic materials are of great importance, *some of them being widely used in place of metals.* 7. They have to compare their experiments, *their results being different.* 8. *The data having been obtained,* we discussed the results at the conference. 9. *Water being heated,* it boils at 100°C.

44. Прочитайте и переведите следующие предложения, обращая внимание на причастные обороты.

1. The molecules of the solid when heated break out of the lattice, the solid melting. 2. Gaining enough energy to move far apart, the molecules often collide with the sides of the container they are in. 3. The students investigating this phenomenon carry out the experiments in the laboratory of general chemistry. 4. Breaking out of the lattice the molecules of the solid gain enough energy, being free to move. 5. The experiment being carried out by the researcher deals with the liquid state of matter.

45. Переведите следующие предложения.

1. The evaporation increases with the temperature, other things being equal. 2. In the steam engine the fuel burns comparatively slowly, the heat being used to generate steam. 3. Power is the basic of civilization, all industry and transport being dependent upon power in some form. 4. X-rays are usually producted by bombarding a metal target with a beam of heigh voltage electrons. This is done inside a vacuum tubes, the X-rays passing out through the glass wall of the tube in a well-defined beam. 5. A small amount of sugar being heated in a test-tube, the sugar melts, turns brown in color, gives off gases and finally dries to a solid black residue which can be identified as carbon. 6. There being no other traffic, the drivers own maintain a constant speed of, say, 60 km/hr. 7. Petroleum being undoubtedly of organic origin, it is still a matter of some doubt whether of vegetable or animal origin.

46. Прочитайте и запомните следующие примеры, обращая внимание на перевод герундия.

The Gerund (Герундий)

1. Reading books is pleasant.	*Читать (чтение)* книг приятно.
2. I don't remember **speaking** to him about it.	Я не помню, *чтобы* я *говорил* с ним об этом.
3. The experiment resulted in **obtaining** valuable data.	Эксперимент привел к *получению* ценных данных.
4. He stopped **writing** and joined the discussion.	Он перестал *писать* и присоединился к дискуссии.
5. He got a chance of **obtaining** good results.	У него была возможность *получить* хорошие результаты.
6. On **heating** ice melts.	При *нагревании* лед тает.

47. Прочитайте и переведите следующие предложения, обращая внимание на герундий.

1. She stopped talking and began reading a book. 2. On being told the news she sent him a letter. 3. The result may be achieved by inverting a test-tube filled with water. 4. The liquid is evaporated by warming gently over Bunsen flame. 5. Bubbles of gas begin appearing above each electrode.
6. Atoms are excited by heating, electric discharge, etc. 7. This effective result is determined by studying the structure of molecules and crystals.

48. Прочитайте и переведите следующие предложения по модели.

Модель:

D.I. Mendeleyev's **having discovered** the Periodic Law made a revolution in chemistry.	*То, что* Д.И. Менделеев открыл периодический закон, сделало революцию в химии.

1. Henry Becquerel's having discovered the phenomenon of radioactivity resulted in many investigations in this field. 2. Besides being a great theoretician D.I. Mendeleyev paid much attention to the development of petrochemical industry. 3. In addition to using analytical balances many scientists use electronic ones.

49. Прочитайте и переведите следующие предложения, обращая внимание на ing-формы.

1. This surgeon is capable of performing the most complicated operations. 2. The heating is used to bring about the arrangement of the crystalline structure in the desired way and give it the required properties. 3. Iron, cobalt and nickel are the only metals possessing considerable magnetism at low temperature. 4. Chemical metallurgy includes the metallurgical processes involving

chemical change and the methods of production. 5. A polymer is a substance consisting of molecules which are made up of low-molecular-weight units.

50. Переведите группы слов, обратите внимание на перевод предлога перед ing- формой, выраженной герундием.

in - при; **on, upon** - по, после; **by** - путем, при помощи; **without** - без

1. On developing this reaction... 2. On receiving such a t°... 3. By raising t° to such a high point... 4. Without employing this reactor... 5. In finding this solution... 6. In marking the element...

51. Прочитайте и запомните следующие примеры, обращая внимание на перевод инфинитива.

Инфинитив (The Infinitive)

Действительный залог (Active Voice)

1. He asked me **to give** him this book.	Он попросил меня *дать* ему эту книгу.
2. He was satisfied **to have translated** this article.	Он был доволен тем, *что перевел* эту статью.
3. They had to take part in the conference.	Они должны были *участвовать* в конференции.

Страдательный залог (Passive Voice)

1. I didn't want this text **to be translated** by him.	Я не хотел, *чтобы он переводил* этот текст.
2. The students were glad **to have been given** excellent marks.	Студенты были довольны тем, *что получили* отличные оценки.
3. The report had **to be delivered** by the lecturer.	Лектор должен был *прочесть* доклад.

52. Прочитайте и переведите следующие предложения.

1. He proposed to use a new method of collecting data. 2. We had to return the books to the library because we were not allowed to borrow some new ones. 3. We were glad to see them. 4. He wanted the new method to be used in our laboratory. 5. This experiment was not difficult to be carried out in the students' laboratory. 6. We were proud to have been given prizes for our research.

53. Прочитайте и запомните следующие примеры, обращая внимание на перевод инфинитива.

a) 1. **To increase** the surface of the liquid means to accelerate the process of evaporation.	*Увеличение* поверхности жидкости означает *ускорение* процесса испарения.
2. **To examine** matter means to	*Исследовать* вещество значит *рас-*

consider its nature and structure.	*смотреть* его природу и структуру.
3. **To explain** this fact is not so very easy.	*Объяснить* этот факт не так-то легко.
б) 1. There remain two constants **to be measured.**	Остаются две константы, *которые надо измерить.*
2. The discharge **to be studied** passes between the electrodes A and B.	Разряд, *который надо изучить,* проходит между электродами А и В.
3. The line **to be drawn** will pass through this point.	Линия, *которую надо провести,* пройдет через эту точку.
в) 1. **To describe** this phenomenon you must introduce new data.	*Чтобы описать* это явление, надо ввести новые данные.
2. **To obtain** an increased temperature it was necessary to use a new device.	*Чтобы получить* повышенную температуру, необходимо было использовать новый прибор.
3. The thermometer is used **to measure** temperature.	Термометр используется *для измерения* температуры.

54. Прочитайте и переведите следующие предложения.

1. To use the energy of a moving body was proposed in the early days of mechanics. 2. To solve our problem we have used many methods described in this book. 3. To speed up the process of evaporation means to increase the surface of the liquid. 4. To know the quantity of energy present in a body is very important.

55. Прочитайте и переведите следующие предложения, обращая внимание на инфинитив (см. примеры упр. 51, 53).

а) 1.Recently they have done a lot of work to investigate the effect concerned. 2.To carry out this experiment is very important. 3. To obtain these results a lot of work had to be done.

б) 1.The experiment to be followed by a discussion was very interesting. 2.The material to be attacked by an acid was placed in a beaker. 3.His article to be referred to later was published last month.

в) 1.D.I. Mendeleyev was the first to arrange the elements according to their atomic masses. 2. The element 101 was the first to have been given the name of a Russian chemist. 3. One of the first man-made elements to be obtained was polonium.

56. Прочитайте и запомните следующие примеры; обратите внимание на перевод инфинитива после выделенных курсивом слов.

а) 1. *The aim* of this experiment is	Цель этого эксперимента *получить*

to get new data.	новые данные *(получение* новых данных).
2. *The task* of the conference is to discuss this phenomenon.	Задача конференции *обсудить* это явление *(обсуждение* этого явления).
3. *The purpose* of his investigation is to obtain reliable results.	Цель его исследования *получить* надежные результаты *(получение* надежных результатов).
6) 1. It is *too* early to discuss our results.	Слишком рано, *чтобы обсуждать* наши результаты.
2. We got *enough* (sufficient) data to describe this experiment.	Мы получили достаточно данных, *чтобы описать* этот эксперимент.

57. Прочитайте и переведите следующие предложения.

1. The purpose of this paper is to show that there is a rather good agreement between experimental results and theoretical predictions. 2. The problem is to use the pressure of the water passing through in great quantities. 3. One of the most important aims of chemistry is to obtain new substances. 4. However the behaviour of this compound has sufficient explanations to differ from the behaviour of that one. 5. The solution is too cool to be used in the reaction. 6. The effect of solubility is too small to be taken for granted.

58. Прочитайте и запомните следующие примеры, обращая внимание на перевод.

Комплекс «Именительный падеж с инфинитивом»
(The Complex Subject)

1.D.I. Mendeleyev **is known** to be a great Russian chemist.	а)*Известно,* что Д.И. Менделеев великий русский химик. б)Д.И. Менделеев, *как известно,* великий русский химик.
2.The students **were seen** to play tennis in the sports ground.	а) *Было видно,* как студенты играют в теннис на спортивной площадке. б)*Видели,* как студенты играют в теннис на спортивной площадке
3.The Periodic Table **proved** (seemed, happened, appeared) **to be** a reliable system for the arrangement of elements.	а) *Оказалось,* что периодическая таблица является надежной системой расположения элементов. б) Периодическая таблица, *как оказалось,* является надежной системой расположения элементов.
4. This law **is likely to be used** in science universally.	а) *Вероятно,* этот закон применяется повсеместно в науке.

	б) Этот закон, *по-видимому,* применяется повсеместно в науке.
5. He **is unlikely to** come tomorrow.	*Маловероятно, что* он приедет завтра.

59. Прочитайте и переведите следующие предложения.

1. They are known to take an active part in social work. 2. The students are heard to speak in the corridor. 3. The experiment was supposed to be carried out next week. 4. He seems to report at the conference. 5. My friend appears to be a good experimenter. 6. The method happened to be very useful. 7. This technique proved to be reliable. 8. They are likely to pass their exams successfully. 9. The two lines are found to coincide in the point indicated above.

60. Прочитайте и запомните примеры.

а) Обратите внимание на место отрицания при переводе.

1. The volume does not appear to increase.	Оказывается, объем *не* увеличивается.
2. The substance is not supposed to have been heated.	Полагают, что вещество *не* было нагрето.
3. The theory does not seem to explain this fact.	Кажется, что теория *не* объясняет этот факт.

б) Обратите внимание на место модального глагола.

1. The substances may seem to have changed.	*Может* показаться, что вещества изменились.
2. Cosmic rays can be expected to be a form of radiation.	*Можно* считать, что космические лучи являются видом радиации.

61. Прочитайте и переведите следующие предложения.

1. Bases do not appear to be tasteless. 2. This method does not seem to be important for the production of hydrochloric acid commercially. 3. Most bases can be regarded to be electrovalent compounds. 4. Bases may seem to be produced by adding an active metal to water.

62. Прочитайте и запомните следующие примеры, обращая внимание на перевод.

Комплекс «Объектный падеж с инфинитивом»
(The Complex Object)

1. We know **D.I. Mendeleyev to formulate** the Periodic Law.	Мы знаем, *что Д.И. Менделеев сформулировал* периодический закон
2. At present time scientists consider **109 substances to be** elements.	В настоящее время ученые считают, *что 109 веществ являются*

	элементами.
3. On the screen they have seen the electric **discharge pass** through the circuit.	Они видели на экране, как электрический *заряд прошел* по цепи.

63. Прочитайте и переведите следующие предложения.

1. D.I. Mendeleyev predicted certain elements to be missing from the Table. 2. We know acids and bases to be extremely useful substances. 3. The students expected the properties of all water solutions of acids to be due to hydronium ion. 4. We know the hydrochloric acid to be one of the most important acids. 5. They found bases to be electrovalent compounds.

64. Прочитайте и переведите следующие предложения, обращая внимание на инфинитивные конструкции.

1. In this experiment the scientists seemed to have included some new compounds. 2. The attraction is assumed to be increasing with heating. 3. The experimental data are said to coincide with the theoretical expectations.
4. Oxygen is known to be the most abundant element. 5. The diagram is likely to have been printed in this book. 6. This group is likely to include all the cases mentioned above. 7. Strength of current was measured by the scientist who found it to be of the order of a hundred amperes. 8. The result showed the minerals to have been subjected to heating. 9. We consider a given volume of water at a definite temperature to be capable of diluting a certain quantity of salt. 10. The kinetic theory of gases assumes gases to be made up of molecules moving about chaotically.

65. Прочитайте и переведите следующие группы слов, обращая внимание на то, как меняется перевод инфинитива в зависимости от его места в предложении.

1. The direction to be changed... 2. The direction is found to be changed... 3. To change the direction we must... 4. To change the direction means some... 5. For the direction to be changed... 6. I expect the direction to change...

66. Прочитайте и переведите по модели следующие приложения, обращая внимание на перевод «for + существительное + инфинитив».
Модель:

For the crystals of salt to be formed water must be evaporated.	*Чтобы (для того чтобы) образовались кристаллы соли,* необходимо выпарить воду.

1. For the reaction to begin it is necessary to heat the solution. 2. For the chemical change to take place you must increase temperature. 3. For the reaction to take place we have to combine two solutions. 4. A lot of time is need-

ed for the crystallization to occur. 5. For a quantity of watts to be obtained we multiply volts by amperes.

67. Прочитайте, переведите предложения. Определите, в каких предложениях for *имеет следующие значения:*

а) так как *(перед подлежащим);* поскольку
б) для того чтобы
в) в течение
г) для

1. *For* polimerization to occur at low temperature hydrogen peroxide is found to be extremely satisfactory. 2. There is no real meaning to the term "Absolute Motion" *for* we do not know anybody to be absolutely at rest. 3. This property has been retained *for* a long time. 4. The effect considered is so weak that delicate methods are necessary *for* its detection. 5. Field strength is a vector quantity *for* it possesses both magnitude and direction. 6. *For* many centuries there existed an atomistic theory.

68. Прочитайте, переведите предложения.

1. To understand the nature of this phenomenon was very difficult. 2. To understand the nature of this phenomenon we repeated the experiment several times. 3. The gas to be liquefied is a mixture of at least three components.
4. The purpose of their experiment is to find a solvent for this mixture. 5. He is to find another method of solving this problem. 6. The subjects to be discussed at this conference are very important for the work of our laboratory. 7. To get accurate results they used a very sensitive balance. 8. To get accurate results was impossible in this case. 9. The students are to test the accuracy of the results received during the previous laboratory work. 10. Boyle was the first to have a clear concept of “element”. 11. The process to be treated now in more detail is known as ionization. 12. An important consideration to bear in mind is that in many structures two more different types of bonds may operate simultaneously between different atoms.

69. Прочитайте, переведите предложения.

1. In this case the atom may be expected to radiate energy. 2. Air was considered to be an element. 3. Particle A moves in a circle with constant speed, and is said to be in uniform motion. 4. The substance has been insolated in a free form and been stated to fluoresce in dark. 5. The basic theory of the effect is discussed and found to be substantially in agreement with the exp.results. 6. A precipitate which happens to be an extremely slightly soluble may fail to be dissolved completely. 7. There does not appear to be an agreement between these results. 8. They can hardly be said to have discovered this phenomenon. 9. Substances that may be easily shown to possess these properties are classified as follows. 10. In moist air copper tarnishes and forms a

protective coating of what is said to be green basic carbonate. 11. This reaction may be shown to go on at temperatures as low as – 120°C. 12. Our sun is a member of a group of dwarf red stars in which iron is revealed by spectroscope to be very plentiful. 13. Above – 100°C the oxide decomposed slowly to give what was at first thought to be a new oxide FO. 14. For these reasons our preliminary values of the expansion of copper cannot be expected to be reliable at low temperatures. 15. The atomic weight of radium was found by madam Curie in 1903, by the analysis of radium chloride to be approximately 225. 16. The presence of helium in uranium and thorium ores had already been noticed and was seen to be significant. 17. The scientist expected this to fluoresce. 18. The scientist was expected to make a report about his new discoveries. 19. This substance was expected to fluoresce. 20. This substance was expected by the scientist to fluoresce.
21. Can you prove this substance to be an element? 22. This substance proved to be an element. 23. The atomic weights have been assumed to be integral. 24. Let us assume the atomic weight to be integral. 25. The nucleus has been shown by recent research to be an extremely complex structure. 26. Recent research has shown the nucleus to be exceedingly complex structure.
27. Uranium X proves to be isotopic with, and chemically inseparable from, thorium. 28. Joule and other scientists proved heat to be a form of energy.
29. This law is generally taken to apply to all gases and their mixtures. 30. In this case of the atom, the potential energy of the electron is taken to be zero when removed from the sphere of influence of the nucleus. 31. For nearly a century after Dalton formulated the atomic theory, atoms were assumed to be the theory, atoms were assumed to be the invisible particles of the elementary substance. 32. We may assume this to be the case. 33. The alpha particle has atomic mass, so that its passage through matter might be expected to cause disruptive effects. 34. Their method was to add radon to the substance to be examined. 35. They would expect the acceleration to be different for different weights but this is not the case.

70. Прочитайте, переведите предложения.

1. Chloromycetin has been found to be effective against a wide variety of infectious agents. 2. The fiber industry is considered to be independent of the plastic industry. 3. X-ray analysis proved some of high-molecular weight natural products to be crystalline and others to be amorphous. 4. Some plastics proved to be both crystalline and amorphous depending on the state of the product. 5. In order that a chemical compound can be made to cadence to a material of high molecular weight, it contains two or more functional groups which can react with one another. 6. The nitration reaction is a very complicated one, including a heterogeneous system of cellules, nitric and sulphuric aids and water where each constituent appears to play several roles which are

both physical and chemical in nature. 7. Since cellulose is a polyhydric alcohol, chemists can make it undergo etherification reactions.
8. Other celluloses and in particular ethyl cellulose were found to be soluble in organic liquids. 9. Molten sodium chloride has been shown to be a good conductor of electricity. 10. The noble gases are shown by their extreme chemical inertness to have especially stable electronic structures. 11. The bond which consists of a pair of shared electrons is said to be a "covalent bond". 12. Metals and intermetallic compounds seem to be aggregates of metal captions bound together by valent electrons which have considerable freedom of motion through the specimen. 13. Metallic valence of the alkali metals is likely to be I and that of the alkaline earth metals to be II.

71. Прочитайте, переведите предложения.

1. This substance is to be found in nature. 2. The metal to be found in this ore is of great value. 3. He found this substance to be very valuable. 4. The teacher wants this text to be translated at the lesson. 5. The text to be translated at the lesson was brought by the teacher. 6. This text is expected to be translated without a dictionary. 7. This text is to be translated without a dictionary. 8. They consider this book to be difficult. 9. This book is considered to be difficult. 10. These phenomena are to be taken into consideration. 11. The phenomena to be considered are very complicated.
12. The radius of our orbit is believed to be increasing very slowly. 13. The copper to be refined is cast into large plates. 14. The property allows the alpha particle to be detected. 15. There appear to be two particles to be detected. 16. Electrons can be made to travel at very high speeds. 17. I believed water always to expand when heated, but I was wrong, its density is greatest at $4^{o}C$. 18. The idea of nuclear charge and atomic number is now realized to be most important. 19. The cooling is affected by methods to be discussed in the next chapter. 20. A certain period of time must be allowed for the oil drops to be removed by the electric field or by precipitation.

72. Прочитайте, переведите предложения.

1. There appears to be direct evidence of the existence of negative electrons in matter. 2. The distance d was calculated from equation I-25 and found to be 2,814 angstroms. 3. The amount of polonium to be obtained from a uranium minerals can be calculated. 4. The best agreement is to be found in the case of carbonic acid. 5. The nucleus will be taken to be at rest. 6. We may suppose the alpha particles within the nucleus to be in motion. 7. Ordinary objects are not likely to move with a velocity approaching the velocity of light. 8. The lithium nucleus is too small for so many collisions to occur. 9. Secondary radiation may by expected to rise when the primary radiations are observed. 10. Light is to be considered as some kind of wave motion of electromagnetic origin. 11. There is no reason for the conversion of mechanical into radiated

energy to be continuous. 12. Alpha rays were shown to be identical, no matter from what radioactive element they are emitted. 13. There is no definite molecular weight to be ascribed to water when in a liquid state.
14. Pitchblende was shown by X-ray and emission examination to have been a mixed salt. 15. It will be necessary for the observer to remain in the dark at least ten or fifteen minutes to accustom his eyes to the darkness. 16. In liquids and solids, however, the movement of molecules must be supposed to be more restricted. 17. One may consider the charge-exchange reaction to have been established under these conditions. 18. Radium appeared to be an element, whose salts were found to be isomorphous with the corresponding salts of barium. 19. The nucleus of every atom is assumed to contain enough protons to account for the nuclear charge. 20. At first the alpha rays were thought to be undeviated by the magnetic fields. 21. As information accumulated, it became possible to plan experiments that were likely to yield the material sought for.

Модальные глаголы и их эквиваленты

73. Переведите следующие предложения, обращая внимание на выделенные курсивом модальные глаголы и их эквиваленты.

1. We *must* use new methods in our research work. 2. You *may* take my paper. 3. He *can* read English books. 4. He *couldn't* complete his research in time as he worked very slowly. 5. The students *were unable* to do the work without their teacher's help. 6. He *had to* work hard in order to complete the work in time. 7. You *will have to* show the results to your teacher. 8. Nobody *was able to* understand this phenomenon. 9. As the student was late he *was not allowed to* enter the classroom. 10. You *should* stay at home as you are ill. 11. You *should* go there tomorrow, there *ought to* be more buses in the morning.

74. Прочитайте, переведите предложения, поставьте модальные глаголы, выделенные курсивом, в прошедшем и будущем времени.

1. I *can* help you. 2. He *can* do it himself. 3. We *can* show you how to experiment with this substance. 4. She *can* find a good answer. 5. He *may* stay here for some time. 6. She *may* take this book home. 7. You *may* finish your work at 5 o'clock. 8. I *must* do this exercise. 9. She *must* wait for him.

75. Составьте вопросы и ответы по моделям, используя сочетания слов, данные ниже.

Модель 1:

Can you (he, we, they) *speak English?*

Yes, I can. No, I can't.

to speak German, to skate, to play chess, to translate English articles, to help me, to stay with us

Модель 2:

May I (he, we, they) *stay here?*
Yes, you may. No, you may not.
to come in, to answer a question, to take a journal, to leave the room, to join the discussion

76. Прочитайте, переведите предложения. Изучите и запомните способы выражения долженствования.

The students must attend lectures.	*долженствование, долг, необходимость*
They have to translate this text in time.	*необходимость, обязанность*
He is to come at 9 o'clock.	*долженствование, обусловленное договоренностью, планом*
You should consult the doctor.	*совет, рекомендация*
We ought to defend our Motherland.	*(моральный) долг, долженствование*

77. Переведите следующие предложения, используя материал упр. 76.

1. You must not be late. 2. The lecture is to begin at 8 o'clock. We ought to come in time. 3. He had to work hard before he was able to make a report at the conference. 4. One should turn off the gas when one leaves home. 5. We ought to say that the discovery of atomic energy is as important as the discovery of fire. 6. We should discuss this problem at the meeting. 7. The engineer will have to improve this device.

78. Переведите следующие предложения.

1. Using radioactive isotopes, biologists and agriculturalists will be able to carry out research impossible by any other method. 2. We shall have to work out an experiment in which we shall be able to keep the particles in the plasma, that is, deprive them of the possibility of transmitting the heat to the walls of the container. 3. The compass used by a pilot has to be small and light in weight. 4. Thus the second condition for equilibrium is that the tendency to rotate should be zero. 5. According to the law of energy, the energy spent in starting the body must be equal to that derived from the body when it is stopped. 6. It is to be noted that the action and reaction, as the two forces of the pair are called, always act at different bodies – never at the same body. 7. At ordinary temperatures and even temperature intervals which are not too great, specific weight may be considered constant. 8. Surface tension may be expressed in any unit of energy per unit of area. 9. The frequency of an oscillator can be kept constant by means of an oscillating crystal. 10. Heat is a form of energy and may be measured in the units which energy is measured in.

Для заметок

Сводные лексико-грамматические трудности

Задание 1. Определите значение выделенных жирным шрифтом лексических единиц и выделенных курсивом грамматических моделей и переведите на русский язык.

1. Attention *should be paid* to the fact that the reaction rate is **affected** by temperature, concentration, catalyst and so on.
2. Heavy water *differs* from ordinary water in its physical **effects.**
3. **All** the same, the first atomic energy stations *were to be built* well away from the densely populated areas.
4. Electricity *has come* into a general use so recently that one *might think it was discovered* but a few years ago. Such is not the **case.**
5. The increase in the concentration of one of the reactants **causes** the reaction *to go in* the forward direction.
6. So **far** as we know the oil that we obtain from the earth *will not last* more than a few centuries at the present rate of consumption.
7. While liquids and solids are **hardly** compressible, gases, **on the other hand**, *can reduce* their volume under pressure without great difficulty.
8. The process of *isolating* the radium compound from the barium **involved** fractional crystallization.
9. **On account of** its inertness it *would be difficult* **to make** nitrogen combine with **other** elements.
10. *To repeat* this experiment was a **matter** of several hours.
11. The colour of plastics is rather stable, which **means** that they *need to be repainted* less frequently than metals and **other** materials.
12. Experiments *carried out* by this group of chemists **number** hundreds.
13. *Let us repeat* these experiments to confirm the original conclusion **once** more.
14. **Only** a limited **number** of reactions *are known to be influenced* by light.
15. As a general **point,** *it is important to note* that resins with greater fire and smoke resistance *are still being developed*.

Задание 2. Определите значение выделенных жирным шрифтом лексических единиц и выделенных курсивом грамматических моделей и переведите на русский язык.

1. *Provided we are given* all necessary instruments we *shall be able to* continue our investigations.
2. Water **provides** a **means** for the breakdown of the crystal structure, which **results in** the formation of white powder, silver chloride.
3. *Putting* the new plastic to commercial use is out of **question** because it *has not been tested* in a pilot-plant **so far**.

4. *Modern physics has succeeded in transforming* a **number** of chemical elements into **other** elements, in certain **cases** the process **results in** a release of atomic energy.

5. **Because** of the easiness with which white phosphorus **takes** fire, *it must be kept* under water.

6. **Since** the hydrogen atom *is composed of* one proton the **terms** hydrogen ion and proton are synonymous.

7. The **very** first metals *known* to man were, of course, those which *could occur* in the pure or native state.

8. Supersaturated solutions are not stable, they readily **give up** their excess solute *if shaken*.

9. *In order to attain* success in the industrial production of ammonia from its elements *it is necessary to maintain* the gases under **as** high a pressure and at **as** low a temperature **as** possible.

10. **After** *being heated* the particles become thoroughly *welded* together into a compact mass of metal, of specific gravity 21.5.

11. **After** a careful study we *came* to the conclusion that that formula appeared much more complicated than that we *had been using* **before**.

12. *The presence of a catalyst is not sufficient* **for** *the reaction to be started, it is needed* **for** *the reaction rate to be changed*.

13. **Since** the time of Galileo and Newton, knowledge *concerning* the universe *has increased* rapidly.

14. The periodic law says that the properties of elements *when arranged* according to increasing atomic **number**, differ **until** a noble gas appears, and then the same properties (with some modifications) appear again.

15. Gases, *unless highly compressed,* are characterized by extreme lightness **compared to** liquids and solids, while **compared to** gases the former are highly incompressible.

Задание 3. Определите значение выделенных жирным шрифтом лексических единиц и выделенных курсивом грамматических моделей и переведите на русский язык.

1. **One** *has to remember that* this reaction is followed by an explosion.

2. **After** close examination it *will be found* **that** water *occurring* in nature is not pure **for** it *may contain* some salt, dust, etc.

3. In order to separate *charged* particles, it is necessary to surround one or **both** of them by a solvent layer which reduces their attraction for **each other**.

4. *The* more surface of the material is exposed to the air, *the* more rapidly burning **takes place**.

5. *If we mix* metallic zinc with dilute hydrochloric acid, zinc **replaces** the hydrogen in the hydrogen chloride.

6. The reactions *discussed* are often **referred to** as oxidation. 8. The data obtained were with reference to water vapour pressure.

7. *Receiving* data about the quality of the product **through** various operations of a quality sensor the computer instructs the actuators to alter variables in the process.

8. *When evacuated* the two halves of the chamber cannot separate **due to** atmospheric pressure.

9. The relative density of a gas is equal to the molecular weight of the **other** gas (usually hydrogen) *being used as* a standard.

10. *If the gas is collected* over water, the pressure **due to** water vapour *must be taken* into consideration *while calculating* the volume of the gas.

11. *Having prepared* everything for the experiment, they reviewed **once more** the theoretical background for its fulfillment.

12. **Once** he *started talking* on his favourite subject, nothing *would stop* him.

13. This method *is unlikely to be suitable* in this **case**.

14. The choice of a method **depends on** the problem *to be solved*.

15. We were not sure **whether** this new metal *would meet* the requirements of our industry.

Задание 4. Переведите на английский язык.

1. На рис.1 показаны результаты эксперимента.
2. **Найдено**, что ряд микроорганизмов производит аминокислоты.
3. **Были** использованы разнообразные методы исследования.
4. В следующем разделе книги **будут** рассмотрены статистические данные.
5. Данную статью **следует** опубликовать в журнале “Chemical Reviews”.
6. **Полагают**, что теоретические аспекты проблемы **будут** обсуждены позже.
7. Открытие было сделано молодым ученым.
8. Эта конференция была организована Российской академией наук.
9. За явлением наблюдали с помощью различных измерительных приборов.
10. Микроскопические дефекты обнаруживаются с помощью этой методики.
11. Существование этого факта **должно** быть проверено.
12. В настоящий момент <u>**не**</u> проводятся никакие наблюдения на электронном микроскопе.
13. Этот факт объясняется законом сохранения энергии.
14. Здание химической лаборатории построено в прошлом году.

Задание 5. Переведите на английский язык.

1. Компьютерной обработке данных обычно предшествует ряд экспериментов.
2. На этом симпозиуме будут обсуждаться актуальные проблемы устойчивого развития общества.
3. Нам сообщили, что на семинаре была выдвинута (to advance) новая концепция волоконной проводимости.
4. На устаревшее оборудование (out-of-date) нельзя полагаться.
5. На факте необычных изменений в свойствах материала настаивают ученые.
6. О сложностях решения этой проблемы сейчас много говорят.
7. Многочисленные ошибки в наблюдениях приписывают наличию примесей в образцах.
8. Сообщение молодого ученого было внимательно заслушено.
9. Список научной литературы по данному вопросу читатель может найти в конце главы.
10. От полного объяснения полученных научных фактов нельзя отказаться.
11. На его эксперимент ссылаются в статье.
12. На результаты наших исследований можно положиться.
13. В этой главе рассматривается броуновское движение.
14. Ему дали новый журнал.
15. Нам показали новую лабораторию.

Задание 6. Переведите на английский язык.

1. В настоящее время особое внимание уделяется геотермальной энергии (geothermal).
2. Следует воспользоваться новыми возможностями (opportunities) для инвестиций в экономику страны (to invest in economy).
3. Следует использовать источники энергии в Северном Ледовитом океане (power resources in the Arctic Ocean).
4. Эффект концентрации на калориметрическую энтальпию часто используется.
5. Была сделана попытка улучшить механические свойства образцов.
6. Необходимо проявлять осторожность при обращении с радиоактивными веществами (in handling smth).
7. Предпринимаются усилия внедрить высокие технологии в пищевую промышленность.
8. Принимается во внимание степень ионизации солей в растворе.
9. На атмосферу больших городов оказывают влияние промышленные газы.

10. При исследованиях предпочтение оказывается надежным методам.
11. Эта научная конференция проводится в нашей стране каждый год.
12. Химический завод строится сейчас в нашем городе.
13. Наша лаборатория построена в этом году.
14. Когда мы приехали в этот город, новый химический завод еще строился.
15. Химический завод был построен в этом городе до того, как мы туда приехали.

Список сокращений

(A)
Список сокращений из текстов основного урока.

Урок 1

chem.	chemistry/chemical	химия/химический
biol.	biological	биологический
mol.	molecule/molecular	молекула/молекулярный
mol. wt.	molecular weight	молекулярный вес

Урок 2

sci.	scientific	научный
hyp. (=hypoth.)	hypothesis	гипотеза

Урок 3

elect.	electricity/electric(al)	электричество/ электрический
mag. (=magn.)	magnetic	магнитный
opt.	optics/optical	оптика/оптический

Урок 5

nanotech	nanotechnology	(спец.) «нанотехнология»
nsec	nanosecond	наносекунда

Урок 6

BSc	Bachelor of Science	бакалавр (естественных *или* точных) наук
DNA	deoxyribonucleic acid	дезоксирибонуклеиновая кислота (ДНК)

Урок 7

class.classic(al)/classify/classified/classification – классический/классифицировать/классифицированный (систематизированный)/классификация

V. (=vol.)	volume	объём/том
e.g.	exempli gratia	(лат.) например

Урок 10

med.	medicine/medical	медицина/медицинский
MD	Doctor of Medicine	доктор медицины

MSc (=M.Sc.)=MS (=M.S.) Master of Science – магистр (естественных *или* точных) наук

Урок 11

eco-activity	борьба с загрязнением биосферы
ecocatastrophe	глобальная экологическая катастрофа
ecocide	экоцид, разрушение природной среды
ecodevelopment	экоразвитие (экономическое развитие с учетом экологических факторов)
ecofreak	(разг.) экоманьяк, фанатичный приверженец охраны окружающей среды
eco-fuel	экотопливо
econiche	экологическая ниша
ecopolitics	экологическая политика

Урок 12

etc.	et cetera	(лат.) и так далее
i.e.	id est	(лат.) то есть
Ph.D.	Doctor of Philosophy	доктор философии
Pharm.D.	Doctor of Pharmacy	кандидат фармацевтических наук
RPh's	Registered Pharmacist	член фармацевтического общества

(Б)

Список наиболее часто встречающихся латинских сокращений

В англоязычных текстах, в том числе научных, могут использоваться различные сокращения, пришедшие из латыни. Ниже приводятся наибалее распространённые латинские сокращения и их перевод.

a (annus)	год
A.C. (Ante Christum)	до новой эры
a.c. (anni currentis)	сего дня, текущего года
A.D. (Anno Domini)	новой эры
a.m. (ante meridiem)	до полудня, утра
aq. (aqua)	вода
B.C. (before Christ)	до новой эры
ca. (circa)	приблизительно, около
cf. (confer)	сравни
cc (cubic centimetre)	кубический сантиметр
corr. (corrigenda)	подлежащее исправлению
c.v. (curriculum vitae)	(авто)биография, краткие биографические данные, резюме (дословно - жизнеописание)
d (dexter)	правый (например об оптическом изомере)
do (ditto)	то же (употребляется в таблице или колонке во избежание повторения вышестоящих слов или цифр)
e.g. (exempli gratia)	например
emer. (emeritus)	заслуженный (например, о профессоре в отставке)
et al. (et alii)	и другие
etc. (et cetera)	и так далее, и тому подобное (и т.д. и т.п.)
et seq. (et sequentia)	и последующие
gen. (genus)	род
i.e. (id est)	то есть
ibid. (ibidem)	то же, в том же месте (используется в перечнях и таблицах во избежание повторения вышестоящих слов)
in ex. (in extenso)	дословно, полностью (о цитате)
inst. (instant)	текущего месяца (в обозначении дат)
int. al. (inter alia)	между прочим
l (laevus)	левый (например об оптическом изомере)
lb (libra)	фунт

loc.cit. (loco citato)	в (выше)упомянутой (в той же) работе, см. предыдущую ссылку
med. (medium)	середина, средний
memo. (memorandum)	меморандум, докладная записка; заметка на память
N.B. (nota bene)	хорошо отметить, нотабене (отметка, служащая для того, чтобы обратить внимание на данное слово)
op. (opus)	опус
op.cit. (opus citatum)	цитируемое произведение
p.a. (per annum)	год
p.c. (pro centum)	процент
p.f. (prima facie)	на первый взгляд
p.m.: 1) post meridiem	после полудня
2) pro mille	на тысячу, промилле
Q.E.D. (quod erat demonstrandum)	что и требовалось доказать
q.l. (quantum libet)	сколь угодно
s. (sinister)	левый
vs., vers. (versus)	против
v.v. (vice versa)	наоборот
viz. (videlicet)	читается «namely») а именно, то есть, разумеется

(B)
Список наиболее часто встречающихся латинских слов и выражений

В англоязычных текстах, в том числе научных, могут использоваться различные слова и выражения, пришедшие из латыни. Ниже приводятся наиболее распространенные латинские слова и выражения и их перевод.

a (annus)	год
ab initio	сначала, с самого начала, неэмпирический (о расчете)
ab hinc	отсюда; отныне
ad hoc	к этому случаю (специально привлеченный) для данного случая
ab ovo	с самого начала (до словно «от яйца»)
ad absurdum	до абсурда (в доказательстве)
ad infinitum	до бесконечности
addendum (мн. addenda)	добавление, приложение
ante	перед, до, прежде, впереди, выше
ante meridiem (a.m.)	до полудня
aqua regia	царская водка
aqua vitae	водка, крепкий спиртной напиток
aqueous	водный
a posteriori	на основании опыта
a priori	заранее, независимо от опыта
as per	согласно
bis	дважды
c(a)eteris paribus	при прочных равных условиях
contra	против
corpora non agunt nisi solute	вещества не реагируют, не будучи растворены (алхимический принцип)
cum laude	с отличием (диплом)
de integro	заново
e contra	со своей стороны, напротив, наоборот
ergo	следовательно
erratum (мн. errata)	опечатка, ошибка (обычно в конце издания как список опечаток)
in folio	ин-фолио, формат книги или журнала в пол-листа
in re	на деле
in situ	на месте

in statu nascendi	в момент образования, в момент выделения (в химической реакции)
in toto	в целом
in vacuo	в вакууме
in vivo	в естественных условиях
ipso facto	в силу очевидности, самим фактом, тем самым
mea culpa	моя вина, по моей вине
miscellania	сборник разных статей, очерков; разное (букв. смесь)
modus operandi	способ действия
mutatis mutandis	внеся (сделав) соответствующие изменения
natura abhorret vacuum	природа не терпит пустоты (выражение восходит к Аристотелю)
natura rerum	природа вещей
par excellence	по преимуществу, преимущественно
per capita	на душу населения
per ce	само по себе, по существу
prima facie	на первый взгляд
pro et contra	за и против
pro forma	формально, для вида
pro rata	пропорционально
qua	в качестве
quantum sufficit	сколько достаточно, сколько нужно
quo ad hoc	до этой степени
rectus	прямой, правильный
sic!	Так! (в скобках или на полях указывает на точное соответствие оригиналу, или на важность данного места в тексте, или на ошибочность чьих-то приведенных слов)
sui generic	своего рода, своеобразный
terra incognita	незнакомая область
viva voce	устно, лично (букв.- живым голосом)
vide infra	смотри ниже
vide supra	смотри выше
vulgo	в просторечии

Краткий лексико-грамматический справочник

§ 1. Видовременные формы английского глагола изъявительного наклонения в действительном залоге и соответствие русских временных форм временным формам английского глагола

Времена действительного залога русского глагола	Времена действительного залога английского глагола	Предложение на русском языке	Формула английского времени и соответствующее предложение на английском языке
НАСТОЯЩЕЕ время	Present Simple	Они *пишут* письма каждый месяц.	V[2]/$V_{-s/-es}$ They *write* letters every month.
	Present Continuous	Они сейчас *пишут* письма.	am/is/are + V_{-ing} They *are writing* letters now.
	Present Perfect Continuous	Они *пишут* письма уже два часа.	have/has been + V_{-ing} They *have been writing* letters for two hours.
ПРОШЕДШЕЕ время	Past Simple	Они *писали/ написали* письма вчера.	V_{-ed}/V_2 They *wrote* letters yesterday.
	Past Continuous	Они *писали* письма, когда он позвонил.	was/were + V_{ing} They *were writing* letters when he phoned.
	Present Perfect	Они уже *написали* письма сегодня.	have/has + V_{-ed}/V_3 They *have written* the letters today.
	Past Perfect	Они *написали* письма до того, как он позвонил.	had + V_{-ed}/V_3 They *had written* the letters before he phoned.
	Past Perfect Continuous	Они *писали* письма уже два часа до того, как он позвонил.	had been + V_{-ing} They *had been writing* letters for two hours before he phoned.
БУДУЩЕЕ время	Future Simple	Они *будут писать/ напишут* письма завтра.	shall/will + V They *will write* letters tomorrow.
	Future Continuous	Завтра в это время они *будут писать* письма.	shall/will be + V_{-ing} They *will be writing* letters at this time tomorrow.
	Future Perfect	Они уже *напишут письма* к тому времени, когда он позвонит.	shall/will have + V_{-ed}/V_3 They *will have written* the letters by the time he phones.
	Future Perfect Continuous	Они *будут писать* письма уже два часа к тому времени, когда он позвонит.	shall/will have been + V_{-ing} They *will have been writing* letters for two hours by the time he phones.

[2] V = Verb

§ 2. Случаи употребления Present Simple, Present Continuous и Present Perfect Continuous

Present		
Simple	Continuous	Perfect Continuous
действие обычное, регулярно повторяющееся	действие, происходящее в момент речи	действие, начавшееся в прошлом, длившееся в течение некоторого периода времени и ещё продолжающееся в момент речи

Прочитайте и изучите следующие примеры.

Простое настоящее время (Present Simple)

1. **I study** at the University.	**Я** учусь в университете.
He studies at the University.	**Он** учится в университете.
2. **Do** you **study** at the University?	**Вы** учитесь в университете?
Yes, **I do. I study** at the University.	**Да. Я** учусь в университете.
Does she **study** at the University?	**Она** учится в университете?
Yes, she **does.** She studies at the University.	**Да. Она** учится в университете.
3. They **do not (don't) study** at school.	**Они** не учатся в школе.
They **study** at the University.	**Они** учатся в университете.

Настоящее продолженное время (Present Continuous)

1. I **am writing** now.	Я пишу сейчас.
He (she, it) **is** writing now.	Он (она) пишет сейчас.
We (you, they) **are** writing now.	Мы (вы, они) пишем сейчас.
2. He **is not writing** now.	Он (они) не пишут сейчас.
They **are not** writing now.	
3. **Is** he **writing** now?	Пишет ли он (они) сейчас?
Are they **writing** now?	

Настоящее продолженное совершенное время

(Present Perfect Continuous)

1. I **have been writing** for 3 hours.	Я пишу уже 3 часа.
He (she, it) **has been** writing for 3 hours.	Он (она) пишет уже 3 часа .
We (you, they) **are been** writing now for 3 hours..	Мы (вы, они) пишем уже 3 часа.
2. He **has not been writing** now.	Он (они) не пишут 3 часов.
They **have not been** writing for 3 hours.	

3. Has he **been writing** for 3 hours? Have they **been writing** for 3 hours?	Пишет ли он (они) 3 часа?

§ 3. Случаи употребления Future Simple, Future Continuous, Future Perfect и Future Perfect Continuous

Future			
Simple	Continuous	Perfect	Perfect Continuous
однократное, повторяющееся или постоянное действие, относящееся к будущему времени	действие, протекающее в какой-то момент или период будущего времени (за исключением некоторых устойчивых выражений с глаголами to expect, to stay, to see и др. Это время употребляется очень редко)	действие, которое будет закончено до определённого момента или действия в будущем	действие, длящееся в будущем, которое начнётся до какого-то момента или периода будущего времени и будет продолжаться вплоть до этого момента (эта форма глагола встречается очень редко)

Прочитайте и изучите следующие примеры.

Простое будущее время (Future Simple)

1. We **shall have** two lectures tomorrow.	Завтра у нас будут две лекции.
I shall go home after lectures.	Я пойду домой после лекций.
He **will study** chemistry at the University.	Он будет изучать химию в университете.
2. **Shall** we **have** two lectures tomorrow?	У нас будут две лекции завтра?
3. Yes, **we shall**. We **shall have** two lectures tomorrow.	Да. У нас будут две лекции завтра.
4. **Will** they **have** lectures tomorrow? No, they **will not**. They will have lectures on Monday.	У них будут лекции завтра? Нет. У них будут лекции в понедельник.

Будущее совершенное время (Future Perfect)

1. We **shall have completed** the experiment by the end of the month.	Мы уже завершим эксперимент к концу месяца.
2. They **will have passed** the exams by the end of January.	Они уже сдадут экзамены к концу января.
3. Shall we **have completed** the experiment by the end of the	Мы уже закончим эксперимент к концу недели? Да. Нет.

week? Yes, we shall. No, we shall not.

Будущее продолженное время (Future Continuous)

1. We **shall be** They **will be** — **writing** the test from 9 to 10 a.m.	Мы (Они) будем (будут) писать контрольную работу с 9 до 10 часов утра завтра.
2. **Will** they **be writing**...?	Будут ли они писать...?
3. We **shall not be writing**...	Мы не будем писать...

Будущее продолженное совершенное время (Future Perfect Continuous)

1. We **shall have been writing** They **will be have been writing**	Мы (Они) будем (будут) писать контрольную работу уже в течение 3 часов к 12 часам дня завтра.
2. **Will** they **have been writing**...?	Будут ли они писать...?
3. We **shall not have been writing**...	Мы не будем писать...

§ 4. Случаи употребления Past Simple, Past Continuous, Present Perfect, Past Perfect, Past Perfect Continuous

Past			
Simple	Continuous	Perfect	Perfect Continuous
действие, происходившее в какой-то период времени в прошлом и связанное с моментом речи	действие в развитии, незаконченное, происходившее в определённый ограниченный период времени в прошлом	действие в прошлом, которое происходило и закончилось до другого прошедшего действия или до какого-то момента или периода прошедшего времени	длительное действие, которое началось до какого-то момента прошедшего времени и продолжалось вплоть до этого момента
Present Perfect			
действие, совершившееся в прошлом, но имеющее непосредственную связь с настоящим периодом времени, т. е. с моментом речи			

Прочитайте и изучите следующие примеры.

Простое прошедшее время (Past Simple)

1.We **worked** at a plant last year.	Мы работали на заводе в прошлом году.
She **studied** at school last year.	Она училась в школе в прошлом году.
2.**Did** you **work** at a plant last year? Yes, **I did**.	Вы работали на заводе в прошлом году? Да.
Did he **work** at a plant last year? Yes, **he did.**	Он работал на заводе в прошлом году? Да.
3.He **did not (didn't) work** at the plant last year.	Он не работал на заводе в прошлом году.
We **did not (didn't) study** at the University last year.	Мы не учились в университете в прошлом году.

Прошедшее продолженное время (Past Continuous)

1. I (he, she, it) **was** / We (you, they) **were** — **writing** a test for an hour yesterday.	Я (она, он) писал(а) контрольную работу в течение часа вчера.
2. She **was not writing**... We **were not writing**...	Она (мы и т.д.) не писала...
3. **Was** she **writing**...? **Were** you **writing**...?	Писала ли она (мы, вы и т.д.)...?

Настоящее совершенное время (Present Perfect)

1. She **has read** this book.	Она прочитала эту книгу.
2. She **has** never **been** to Moscow.	Она никогда не была в Москве.
3. We **have** often **worked** in this laboratory.	Мы часто работали в этой лаборатории.
4. I **have not seen** him since he graduated from our Institute.	Я не видел его с тех пор, как он окончил наш институт.
5. We **have translated** many articles lately.	Мы перевели много статей за последнее время.

Прошедшее совершенное время (Past Perfect)

1. He **had completed** the experiment by 5 o'clock (5 p.m.) yesterday.	Он завершил эксперимент к 5 часам вечера вчера.
2. They **had** already **completed** the experiment when he came in.	Они уже завершили эксперимент, когда он вошел.
3. She said that she **had taken part** in the conference.	Она сказала, что она принимала участие в конференции.
4. **Had** he **completed** the experi-	Он закончил эксперимент к 5 часам

ment by 5 p.m. yesterday? Yes, he had. No, he had not (hadn't).	вечера вчера? Да. Нет.
5. He **had not (hadn't) completed** the experiment by 5 p.m. yesterday.	Он не закончил эксперимент к 5 часам вечера вчера.

Прошедшее продолженное совершенное время

Past Perfect Continuous

1. I (he, she, it) had bee We (you, they) had bee	**writing** a test for an hour when I came.	Я (она, он) писал(а) контрольную работу в течение часа когда я пришел.

2. She **had not beenwriting**... We **had not been writing**...	Она (мы и т.д.) не писала...
3. **Had** she been **writing**...? Had you been **writing**...?	Писала ли она (мы, вы и т.д.)...?

§ 5. Согласование (последовательность) времен

В английском языке время глагола в придаточном дополнительном предложении зависит от времени глагола в главном предложении. Это правило называется правилом согласования времен и заключается в следующем:

1. Если глагол-сказуемое главного предложения стоит в *настоящем* времени (обычно Present Simple или Present Perfect) или *будущем* времени (обычно Future Simple), то глагол-сказуемое придаточного предложения может стоять в *любой необходимой по смыслу* временной форме.
2. Если глагол-сказуемое главного предложения стоит в *прошедшем* времени (обычно Past Simple), то и глагол придаточного предложения употребляется в одной из форм *прошедшего* времени или *будущего в прошедшем* (Future in the Past[3])

[3] Future in the Past образуется аналогично формам Future (Приложение 1, § 1), где вспомогательные глаголы *shall* и *will* заменяются на *should* и *would* соответственно.

§ 6. Схема сдвига временных форм в придаточных дополнительных предложениях при согласовании времен

В русском языке		
настоящее время	прошедшее время	будущее время
В английском языке		
Для обозначения действия *одновременного* с действием главного предложения Present Simple меняется на *Past Simple,* Present Continuous на *Past Continuous,* а Present Perfect Continuous на *Past Perfect Continuous.*	Для обозначения действия, *предшествующего* действию главного предложения Past Simple и Present Perfect меняются на *Past Perfect.* Past Continuous обычно не меняется или заменяется формой Past Perfect Continuous. Past Perfect и Past Perfect Continuous остаются без изменения.	Для обозначения будущего действия с точки зрения прошедшего времени Future Simple, Future Continuous, Future Perfect и Future Perfect Continuous заменяются соответствующими формами *Future in the Past.*

§ 7. Условные предложения

В английском языке условные предложения можно разделить на три типа:

Первый тип	Второй тип	Третий тип
Реальные предположения, чаще всего относящиеся к будущему времени. В русском языке они соответствуют условным предположениям с глаголом в изъявительном наклонении. If he **writes** the letter, they **will get** it in two days. Если он **напишет** письмо, они **получат** его через два дня. (Написание и получение письма вполне реально).	*Маловероятные* или *невероятные* предположения, относящиеся к настоящему или будущему времени. В русском языке они соответствуют условным предложениям с глаголом в сослагательном наклонении. If he **wrote** the letter, they **would get** it in two days. Если **бы** он **написал** им письмо, они **бы получили** его через два дня. (Написание, а, следовательно, и получение данного письма в будущем маловероятно).	*Невыполнимые* предположения, относящиеся к прошедшему времени. В русском языке они соответствуют условным предложениям в сослагательном наклонении. If he **had written** the letter, they **would have got it.** Если **бы** он **написал** письмо, они **бы** его уже **получили.** (Письмо не было написано).
Образование глагольных форм		
If … Present Simple, … Future Simple	*If* … Past Simple, … Future Simple in the Past	*If* … Past Perfect, … Future Perfect in the Past

Примечание. Кроме союза **if** *если* придаточные предложения условия могут соединяться с главным предложением также союзами **unless** *если…не*, **provided (that), providing (that), on condition (that)** *при условии что*, **suppose (that), supposing (that)** *предположим (что).*

Запомните следующие примеры, обращая внимание на условные союзы и перевод условных предложений.

Условные предложения (Conditional Sentences)

а)	1. If a substance conducts electricity, it will be heated.	Если вещество *проводит (будет проводить)* электричество, то оно будет нагреваться.
	2. If a metal were heated, it would melt.	*Если бы* металл *нагрели*, он *бы расплавился.*
	3. If a non-metal had been cooled, it would have become brittle.	*Если бы* неметалл *охладили*, он *бы стал* хрупким.
б)	1. Provided the temperature were high, a metal would melt.	*Если бы (при условии, что)* температура была высокая, металл *бы расплавился.*
	2. Unless non-metals had been brittle, they would have been ductile.	*Если бы* неметаллы не были хрупкими, они *были бы* ковкими.
в)	1.Were the temperature conditions normal, this substance would not melt.	*Если бы* температурные условия *были* нормальными, это вещество не *расплавилось бы.*
	2. Had the temperature been raised, we should have got a new alloy.	*Если бы* температура *была* повышена, мы *бы получили* новый сплав.

Обратите внимание на перевод глагола should.

1. I said that I **should carry out** this experiment once more.	Я сказал, что *проведу* этот эксперимент еще раз.
2. If we cooled oxygen to - 192.98°C, we **should (could, might) achieve** its boiling point.	Если бы мы охладили кислород до - 192,98°С, мы *достигли бы (смогли бы достичь)* его точки кипения.
3. If we had obtained good results in our last experiment, **we should have discussed** them at the conference.	Если бы мы получили хорошие результаты в нашем последнем эксперименте, мы *обсудили бы* их на конференции.
4. It is necessary that the work **should be done** (be done) in time.	Необходимо, *чтобы* работа *была выполнена* вовремя.
5. He suggested (insisted, ordered, etc.) that the work **should be done**	Он предложил, *чтобы* работа *была выполнена* вовремя.

(be done) in time.	
6. It **should be noted** (pointed out, etc.) that oxygen is widely used in industry.	*Следует отметить*, что кислород широко используется в промышленности.
7. I **should like** to repeat this experiment.	*Мне бы хотелось* повторить этот эксперимент.
8. Repeat the experiment **lest** you **should make** a mistake.	Повторите эксперимент, *чтобы не сделать* ошибку.

§ 8. Страдательный залог

Если глагол в д е й с т в и т е л ь н о м залоге обозначает действие, производимое подлежащим, то глагол в с т р а д а т е л ь н о м залоге обозначает действие, которое производиться *над* подлежащим.

В отличие от действительного залога в страдательном залоге имеется не четыре, а три временные группы: *Simple*, *Continuous* и *Perfect.* Времена Perfect Continuous, а также Future Continuous в страдательном залоге не употребляются. Из общей формулы страдательного залога

to be		**Past Participle**
(в соответствующем времени действительного залога)	+	(основного глагола)

легко вывести частные формулы всех существующих временных групп.

В русском языке страдательный залог не так употребителен, как в английском, поэтому при переводе на русский язык часто приходится страдательный залог заменять действительным, личные предложения переводить неопределённо-личными или производить замену личной формы глагола на неличную.

Времена страдательного залога имеют в основном те же значения, что и соответствующие времена действительного залога.

Запомните следующие примеры, обращая внимание на образование страдательного залога (Passive Voice)

Настоящее время

Present Simple	am, is, are	
Present Continuous	am, is, are + being	+ Participle II
Present Perfect	have, has + been	

Прошедшее время

Past Simple	was, were	
Past Continuous	was, were + being	+ Participle II
Past Perfect	had + been	

Будущее время

Future Simple	shall, will be	+ Participle II
Future Perfect	shall, will + have been	

Соответствие русских временных форм страдательного залога временным формам английского глагола

Времена страдательного русского глагола	Времена страдательного залога английского глагола	Предложение на русском языке	Соответствующее предложение на английском языке
НАСТОЯЩЕЕ время	Present Simple	Кинетическим методом выведено выражение для … (Кинетический метод используется для вывода выражения …)	A kinetic method is used to derive the general expression for…
	Present Continuous	Кинетический метод используется для …(сейчас)	A kinetic method is being used to derive …
	Present Perfect	Кинетический метод использовали	A kinetic method has been used to derive the general expression for …
ПРОШЕДШЕЕ время	Past Simple	Кинетический метод использовался … (Кинетическим методом было выведено …)	A kinetic method was used to derive the general expression for …
	Past Continuous	Кинетический метод использовался … (в определенный период в прошлом)	A kinetic method was being used …
	Past Perfect	Кинетический метод был использован для вывода … (к определенному моменту в прошлом)	A kinetic method had been used to derive …
БУДУЩЕЕ время	Future Simple	Кинетический метод будет использован ….	A kinetic method will be used to derive …
	Future Continuous	Кинетический метод будет использоваться … (в определенный период в будущем)	A kinetic method will be being used…

Прочитайте и запомните следующие примеры использования и перевода страдательных конструкций.

1. The material is subjected to chemical treatment.	Материал *подвергают* химической обработке. Материал *подвергается* химической обработке.
2. All of these requirements can be satisfied.	Все эти требования могут быть удовлетворены.
3. Toxic reagents should be handled with care.	С токсичными реагентами следует обращаться с осторожностью. (действующее лицо - неважно)
4. An instruction can be found on page 20.	Инструкцию можно найти на стр.20. (действующее лицо – люди вообще)
5. I was fined for speeding.	Я был оштрафован за превышение скорости. Меня оштрафовали за превышение скорости.
6. Some additional information was reported by an investigator.	Исследователь привел дополнительную информацию. Дополнительная информация была приведена исследователем.
7. Living cells are damaged by radiation.	Радиация наносит вред живым клеткам.
8. I was shown some papers on polymerization.	Мне показали некоторые статьи по полимеризации.
9. These terms were agreed upon.	Договорились на этих условиях.
10. I am often laughed at.	Надо мной часто смеются.
11. Steps should be taken to decrease the reaction rate.	Следует принять меры, чтобы уменьшить скорость реакции.
12. These devices were shown preference to because of their simplicity.	Этим устройствам было оказано предпочтение из-за их простоты.

§ 9. Причастие

Причастие – это неличная форма глагола, сочетающая свойства ***прилагательного*** (служит *определением* к существительному и в этой функции соответствует русскому причастию), ***наречия*** (служит *обстоятельством,* определяющим действие, выраженное сказуемым и в этой функции соответствует русскому деепричастию) и ***глагола*** (поэтому имеет формы времени и залога).

Таблица форм причастия

Форма причастия	Непереходные глаголы[*]	Переходные глаголы[**]	
	Действительный залог	Действительный залог	Страдательный залог
Причастие настоящего времени (Present Participle)	going	writing	being written
Причастие прошедшего времени (Past Participle)	gone	______[***]	written
Перфектное причастие (Perfect Participle)	having gone	having written	having been written

Значения причастий

Present Participle	Perfect Participle	Past Participle
Действие, одновременное с действием глагола в личной форме	Действие, предшествующее действию глагола в личной форме	Законченное действие, выполненное над каким-либо объектом

§ 10. Способы перевода английского причастия на русский язык

В функции определения	В функции обстоятельства	В качестве вводного члена предложения
⇒ причастием настоящего времени: writing = пишущий	⇒ деепричастным оборотом: having written = написав ⇒ придаточным предложением:	⇒ деепричастием или вводным предложением с союзом *если*: Considering the im-

[*] Непереходные глаголы - глаголы, которые не могут иметь при себе прямого дополнения (идти/go, бежать/run, жить/live и т. д.)
[**] Переходные глаголы - глаголы, которые могут иметь при себе прямое дополнение (писать/write, читать/read, приглашать/invite и т. д.)
[***] Форма Past Participle непереходных глаголов в действительном залоге самостоятельно не употребляется, а лишь входит в состав сложных форм глагола для образования времен группы Perfect.

⇒ причастием прошедшего времени: written = написанный ⇒ придаточным определительным предложением: … by those writing … = … теми, кто пишет …	Asked to write about …, he … = Когда его попросили написать о …, он … ⇒ самостоятельным предложением или иным способом, в зависимости от сочетаемости слов в русском языке	portance of the written papers… = Если учесть (учитывая) важность написанных документов …

Примечание. Некоторые причастия могут выступать в грамматической функции союза или предлога.

В функции союзов они вводят условные причинно-следственные и уступительные придаточные предложения: **provided** *при условии, что;* **supposing (assuming)** *предположим, что;* **seeing** *ввиду того, что* и т. д.

В функции предлогов они стоят перед существительными: **given** *при наличии,* **failing** *при отсутствии,* **following** *вслед за* и т. д.

Функции причастия устанавливаются в процессе анализа предложения.

Запомните следующие примеры.

Причастие (The Participle)

Причастие настоящего времени (Participle 1)

Действительный залог (Active Voice)

1. I spent a lot of time **mixing**, these liquids.	1. Я затратил много времени *смешивая* эти жидкости.
2. **Dripping** taps must be repaired.	2. *Протекающие* краны надо починить.

Страдательный залог (Passive Voice)

The experiment **being carried out** in our laboratory deals with the properties of inert gases.	*Проводимый* в нашей лаборатории эксперимент связан со свойствами инертных газов.

Причастие прошедшего времени (Participle II)

Действительный залог (Active Voice) отсутствует

Страдательный залог (Passive Voice)

The experimental data **obtained** proved the theory.	*Полученные* экспериментальные данные подтвердили теорию.

Причастие совершенного времени (Perfect Participle)

Действительный залог (Active Voice)

Having discussed the experimental data at the conference he decided to publish them without delay.	*Обсудив* экспериментальные данные на конференции, он решил немедленно их опубликовать.

Страдательный залог (Passive Voice)

The experimental data **having been discussed**, he decided to publish them without delay.	*После того, как* экспериментальные данные *были обсуждены,* он решил немедленно опубликовать их.

Обратите внимание на перевод while, when, if в сочетании с причастием.

I. **While carrying out** the experiment the student should be very careful.	1. *Проводя* эксперимент, студент должен быть очень внимателен. 2. *При проведении* эксперимента студент должен быть очень внимателен.
II. **When heated** up to 100°C water boils.	1. При *нагревании* до 100°C вода кипит. 2. *Когда* воду *нагревают* до 100°C, она кипит.
III. The substance can be readily recognized **if represented** by physical and chemical properties.	1. Вещество можно легко распознать, *если представлены* его физические и химические свойства. 2. Вещество можно легко распознать *при наличии* его физических и химических свойств.

§ 11. Независимый причастный оборот (абсолютная номинативная конструкция) с предлогом with

Причастия в английском языке употребляются в основном в тех случаях, в каких причастия и деепричастия употребляются в русском языке. Что же касается независимого причастного оборота, то эта конструкция уже не существует в русском языке, и поэтому её перевод может вызвать некоторые трудности. Здесь рассматривается лишь один частный случай независимого причастного оборота, вводимого предлогом with.

Препозитивный независимый причастный оборот, т. е. причастный оборот, стоящий *перед* главным составом предложения, имеет либо *временнóе,* либо *причинное* значение и переводится на русский язык соответствующими придаточными предложениями: *Когда.../Так как.../ Поскольку...*

Постпозитивный независимый причастный оборот, т. е. причастный оборот, стоящий *после* главного состава предложения, имеет значение *сопутствующего обстоятельства* и переводится на русский язык самостоятельным простым предложением или простым предложением, входящим в состав сложносочиненного предложения и вводится союзами *а, и* или *причём.*

Предлог *with* на русский язык обычно не переводится.

Изучите следующие примеры, обращая внимание на перевод независимого причастного оборота.

1. **Water playing the most essential part in our lives,** it is universally needed everywhere.	*Так как (поскольку) вода играет основную роль в нашей жизни,* она требуется повсеместно.
2. **Water having evaporated from rivers and seas,** it is deposited on cooling as rain.	*После того как (когда) вода испаряется из рек и морей,* она выпадает, охлаждаясь, в виде дождя.
3. Molecules often collide with the sides of the container they are in, **the liquid taking up the shape of the container.**	Молекулы часто ударяются о стенки сосуда, в котором они находятся, *причем (при этом, а, и) жидкость принимает форму сосуда.*

§ 12 Функции инфинитива в предложении

В английском предложении инфинитив может выступать в следующих функциях:

– подлежащего
– именной части составного именного сказуемого
– части составного глагольного сказуемого
– прямого дополнения к глаголу
– дополнения к прилагательному
– определения
– обстоятельства (цели и результата)

Инфинитив в функции *подлежащего, именной части составного сказуемого, дополнения и обстоятельства цели* не представляет трудности при переводе на русский язык.

Некоторые трудности при переводе может представлять инфинитив в функции *определения* и *обстоятельства результата или следствия.*

Инфинитив в функции

определения	обстоятельства результата или следствия
переводится на русский язык определительным придаточным предложением с *модальным глагольным сказуемым*, выражающим возможность или долженствование, или *глаголом-сказуемым в будущем времени.*	переводится на русский язык *инфинитивом* или *самостоятельным предложением,* вводимым союзом *и* (при наличии слов *enough, so…, too…, only* часто присутствует *модальное* значение)

§ 13 Запомните следующие примеры, обращая внимание на перевод инфинитива.

Инфинитив (The Infinitive)

Действительный залог (Active Voice)

1. He asked me **to give** him this book.	Он попросил меня *дать* ему эту книгу.
2. He was satisfied **to have translated** this article.	Он был доволен тем, *что перевел* эту статью.
3. They had **to take part** in the conference.	Они должны были *участвовать* в конференции.

Страдательный залог (Passive Voice)

1. I didn't want this text **to be translated** by him.	Я не хотел, *чтобы он переводил* этот текст.
2. The students were glad **to have been given** excellent marks.	Студенты были довольны тем, *что получили* отличные оценки.
3. The report had **to be delivered** by the lecturer.	Лектор должен был *прочесть* доклад.

Запомните следующие примеры, обращая внимание на перевод инфинитива.

а) 1. **To increase** the surface of the liquid means to accelerate the process of evaporation.	*Увеличение* поверхности жидкости означает *ускорение* процесса испарения.
2. **To examine** matter means to consider its nature and structure.	*Исследовать* вещество значит *рассмотреть* его природу и структуру.
3. **To explain** this fact is not so very easy.	*Объяснить* этот факт не так-то легко.
б) 1. There remain two constants **to be measured.**	Остаются две константы, *которые надо измерить.*
2. The discharge **to be studied**	Разряд, *который надо изучить,*

passes between the electrodes A and B.	проходит между электродами А и В.
3. The line **to be drawn** will pass through this point.	Линия, *которую надо провести,* пройдет через эту точку.
в) 1. **To describe** this phenomenon you must introduce new data.	*Чтобы описать* это явление, надо ввести новые данные.
2. **To obtain** an increased temperature it was necessary to use a new device.	*Чтобы получить* повышенную температуру, необходимо было использовать новый прибор.
3. The thermometer is used **to measure** temperature.	Термометр используется *для измерения* температуры.

Запомните следующие примеры; обратите внимание на перевод инфинитива после выделенных курсивом слов.

а) 1. *The aim* of this experiment is to get new data.	Цель этого эксперимента *получить* новые данные *(получение* новых данных).
2. *The task* of the conference is to discuss this phenomenon.	Задача конференции *обсудить* это явление *(обсуждение* этого явления).
3. *The purpose* of his investigation is to obtain reliable results.	Цель его исследования *получить* надежные результаты *(получение* надежных результатов).
6) 1. It is *too* early to discuss our results.	Слишком рано, *чтобы обсуждать* наши результаты.
2. We got *enough* (sufficient) data to describe this experiment.	Мы получили достаточно данных, *чтобы описать* этот эксперимент.

§ 14. Комплексы с инфинитивом

Инфинитив в сочетании с существительными или личными местоимениями образует синтаксические комплексы. Синтаксические комплексы – это группы слов без личной формы глагола, выполняющие роль сложных членов предложения и по значению эквивалентные придаточным предложениям.

Инфинитив образует синтаксические комплексы трёх типов: комплекс "Именительный падеж с инфинитивом», комплекс «Объектный падеж с инфинитивом» и комплекс с предлогом for.

§ 15. Комплекс «Именительный падеж с инфинитивом»

Личное местоимение в именительном падеже
(или существительное в общем падеже) + инфинитив

Части данного комплекса отделены друг от друга сказуемым предложения. Глагол-сказуемое может быть трёх видов:

в страдательном залоге	в действительном залоге	сочетание глагола be с прилагательным
с глаголами *мышления* (to think, to know, to consider, to suppose, etc.), *чувств* (to hear, to see), *сообщения* (to say, to report, etc.), *приказания* (to make/ заставлять, to tell/велеть, to order), *просьбы* (to ask), *разрешения* (to allow, to permit), *совета* (to advise): **He** *is said* **to be** a good scientist.	с глаголами to seem, to appear, to turn out (оказаться), to prove (оказаться), to happen: **He** *proved* **to be** a good scientist.	с прилагательными sure, (un) certain, (un) likely: **He** *is certain* **to be** a good scientist. Действие, выраженное инфинитивом, обычно относится к будущему времени.

Предложения с этим комплексом, как правило, переводятся на русский язык сложноподчинёнными предложениями, где главное предложение представляет собой неопределённо-личное предложение типа: «говорят», «известно», «считается» и т. д., а придаточное предложение вводится союзами *что* и *как:*

He is said to be a good scientist.

Говорят, что он хороший учёный.

Если в английском предложении сказуемое стоит в отрицательной форме, то при переводе на русский язык отрицание часто переносится в придаточное предложение:

He is *not* said to be a good scientist.

Говорят, что он *не* очень хороший учёный.

Комплекс выполняет функцию сложного подлежащего.

Запомните следующие примеры, обращая внимание на перевод.
Комплекс «Именительный падеж с инфинитивом»
(The Complex Subject)

1.D.I. Mendeleyev **is known** to be a great Russian chemist.	а)*Известно,* что Д.И. Менделеев великий русский химик. б)Д.И. Менделеев, *как известно,* великий русский химик.
2.The students **were seen** to play tennis in the sports ground.	а) *Было видно,* как студенты играют в теннис на спортивной площадке. б) *Видели,* как студенты играют в

	теннис на спортивной площадке
3.The Periodic Table **proved** (seemed, happened, appeared) **to be** a reliable system for the arrangement of elements.	а) *Оказалось,* что периодическая таблица является надежной системой расположения элементов. б) Периодическая таблица, *как оказалось,* является надежной системой расположения элементов.
4. This law **is likely to be used** in science universally.	а) *Вероятно,* этот закон применяется повсеместно в науке. б) Этот закон, *по-видимому,* применяется повсеместно в науке.
5. He **is unlikely to** come tomorrow.	*Маловероятно, что* он приедет завтра.

Обратите внимание на место отрицания при переводе.

1. The volume does not appear to increase.	Оказывается, объем *не* увеличивается.
2. The substance is not supposed to have been heated.	Полагают, что вещество *не* было нагрето.
3. The theory does not seem to explain this fact.	Кажется, что теория *не* объясняет этот факт.

Обратите внимание на место модального глагола.

1. The substances may seem to have changed.	*Может* показаться, что вещества изменились.
2. Cosmic rays can be expected to be a form of radiation.	*Можно* считать, что космические лучи являются видом радиации.

§ 16. Комплекс «Объектный падеж с инфинитивом»

Личное местоимение в объектном падеже
(или существительное в общем падеже) + инфинитив

Комплекс выполняет функцию сложного дополнения и присоединяется к глаголам, выражающим *желание* (to like, to prefer, to want, to expect, etc.), *физическое восприятие* (to hear, to see, to feel, to watch, etc.), *мышление* (to think, to know, to consider, etc.), *разрешение* (to allow, to permit), *приказание* (to tell/велеть, to make/заставлять, to let, to order), *просьбу* (to ask), *совет* (to advise), *обещание* (to promise):

I *want* **you to become** a good scientist.

Примечание. С глаголами, выражающими физическое восприятие, а также с глаголами to make и to let инфинитив употребляется без частицы **to**:

Let **him become** a good scientist.

Предложения с этим комплексом переводятся на русский язык сложноподчинёнными предложениями с придаточными дополнительными, вводимыми союзами *что, чтобы* и *как:*

I want you to become a good scientist.

Я хочу, чтобы ты стал хорошим учёным.

Запомните следующие примеры, обращая внимание на перевод.
Комплекс «Объектный падеж с инфинитивом»
(The Complex Object)

1. We know **D.I. Mendeleyev to formulate** the Periodic Law.	Мы знаем, *что Д.И. Менделеев сформулировал* периодический закон
2. At present time scientists consider **109 substances to be** elements.	В настоящее время ученые считают, *что 109 веществ являются* элементами.
3. On the screen they have seen the electric **discharge pass** through the circuit.	Они видели на экране, как электрический *заряд прошел* по цепи.

§ 17. Комплекс с предлогом for

Этот комплекс состоит из тех же частей что и комплекс «Объектный падеж с инфинитивом» (§ 16), но включает в себя предлог **for ,** который ставится в начале комплекса.

Комплекс выполняет различные функции: сложного подлежащего, сложного дополнения, сложного определения, сложного предикативна, обстоятельства цели или следствия.

It is necessary **for him to become** a good scientist (сложное подлежащее).

Предложения с этим комплексом переводятся на русский язык при помощи инфинитива или придаточного предложения:

It is necessary for him to become a good scientist.

Ему необходимо стать хорошим учёным.	Необходимо, чтобы он стал хорошим учёным.

Запомните следующие примеры, обращая внимание на перевод. (Комплекс с предлогом for)

1. Here is the article **for you to translate** into Russian.	Вот вам статья для перевода на русский язык.
2. This article is too difficult **for us to translate it** into Russian without a dictionary.	Эта статья слишком трудная, чтобы перевести ее на русский язык без словаря.
3. We waited **for the dean to finish** his conversation over the telephone.	Мы ждали, пока декан закончит разговор по телефону.

§ 18. Модальные глаголы

Модальными глаголами в английском языке называются глаголы, которые выражают не действие, а отношение к нему: возможность, способность, необходимость, вероятность совершения действия, выраженного смысловым глаголом.

Модальными глаголами являются глаголы *can (could), may (might), must, need, should, have (to), be (to), ought (to).* Различные модальные оттенки значения могут также выражать и вспомогательные глаголы *shall* и *will* при образовании будущего времени.

Здесь будут рассмотрены некоторые значения модальных глаголов *can, may* и *must* как наиболее часто встречающихся в текстах научного и научно-популярного стиля.

can (could)	may (might)	must
Кроме своего основного значения умения и способности совершить действие (*могу, умею),* **can** выражает предположение (*может быть, возможно*) или сомнение (*неужели; не может быть, чтобы*). Форма **could** передаёт меньшую уверенность предположения или сомнения. Перфектная форма инфинитива после **can** и **could** относит действие к прошедшему времени.	Кроме своего основного значения разрешения (*могу, можешь*), **may** выражает вполне вероятное предположение, относящееся к настоящему или будущему (*может быть, возможно*) Форма **might** указывает на меньшую уверенность предположения. Перфектная форма инфинитива после **may** относит действие к прошедшему времени.	Кроме своего основного значения долженствования и необходимости совершить действие (*надо, нужно, должен*), **must** выражает предположение со значительной долей уверенности (*должно быть, вероятно, очевидно*). Перфектная форма инфинитива после **must** относит действие к прошедшему времени. Глагол **must** , выражающий предположение, не употребляется в будущем времени и в отрицательных предложениях. В этих случаях используются лексические средства.

§ 19. Модальные слова (фразы)

Модальными словами (фразами) в английском языке называются слова (фразы), которые выражают отношение говорящего к высказыванию: положительную или отрицательную оценку, уверенность, сомнение, предположение, усиление и т. д.

По своему составу модальные слова (фразы) могут быть *простыми* (sure), *производными* (surely) и *составными* (to be sure).

Наиболее употребительные модальные слова (фразы)

уверенности	**сомнения (предположения)**	**(не) одобрения**	**усиления**	**подтверждения**	**отрицания**
sure(ly) to be sure sure enough no doubt naturally of course	maybe perhaps probably most probably	(un) fortunately (un) luckily (un) happily	indeed really	Yes. Oh, yes. Of course Yes, of course. Yes, indeed. Certainly. Most certainly. By all means.	No. Oh, no. Of course not. Certainly not. Not at all. By no means.

Одно и то же модальное слово (фраза) может употребляться в составе предложения (*Perhaps* he will help us.) или независимо (Will he help us? – *Perhaps*.)

В английском языке модальность чаще выражается модальными глаголами (§ 18), а не модальными словами. В русском языке более частотно используются модальные слова, а не модальные глаголы. Это следует учитывать как при переводе с английского языка на русский, так и с русского на английский.

Изучите и запомните способы выражения долженствования.

The students must attend lectures.	*долженствование, долг, необходимость*
They have to translate this text in time.	*необходимость, обязанность*
He is to come at 9 o'clock.	*долженствование, обусловленное договоренностью, планом*
You should consult the doctor.	*совет, рекомендация*
We ought to defend our Motherland.	*(моральный) долг, долженствование*

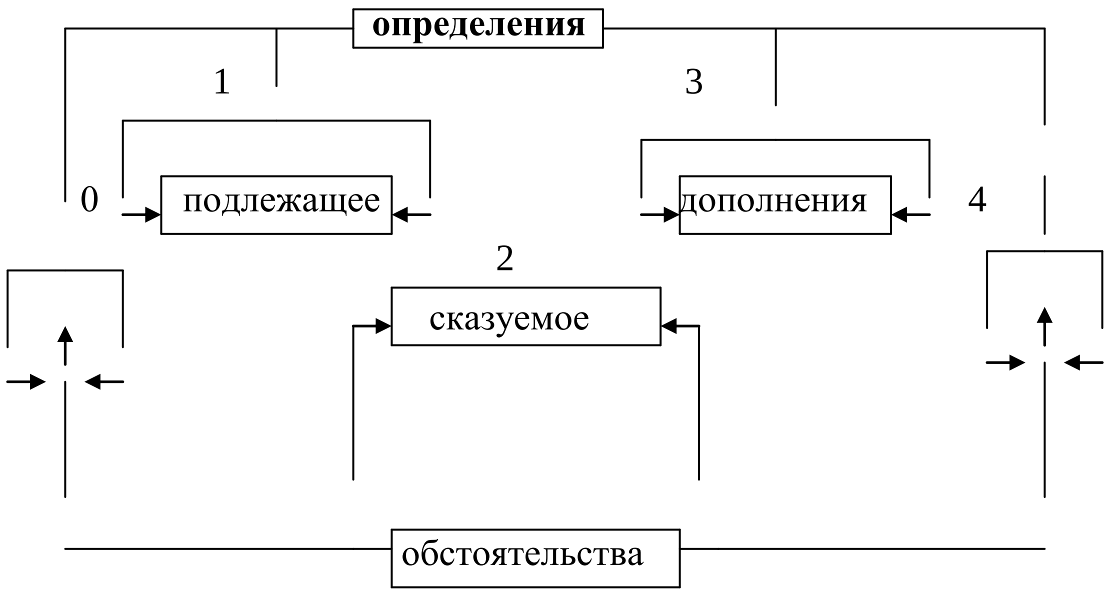
§ 20. Структура английского предложения

Очень важно научиться анализировать предложение: делить предложение на смысловые группы и находить подлежащее, сказуемое и дополнение, т. е. основу предложения.

Для того чтобы адекватно перевести предложение, необходимо понять его смысл. Поискам в словаре должен предшествовать и сопутствовать анализ предложения, выделение смысловых групп. Необходимо овладеть определенными приемами анализа предложения.

Чтобы ориентироваться в предложении, уметь отыскивать сказуемое и другие члены предложения, необходимо знать основные законы, регулирующие порядок распределения слов в английском предложении. В английском языке действует правило «твердого порядка слов», согласно которому сказуемое всегда следует за подлежащим: 1-е место занимает подлежащее, 2-е место занимает сказуемое, 3-е место занимает дополнение.

Расположение слов в английском простом повествовательном предложении:



Сказуемое расположено в центре предложения. Слева от него — подлежащее, а справа — дополнение. Обстоятельства располагаются в начале или в конце предложения, или между подлежащим и сказуемым. Определения, которые могут быть левыми и правыми, определяют или подлежащее, или дополнения, или обстоятельства.

Обратите внимание на следующие предложения:

1 2 3

1. Students read articles.

1 2 3

2. Now the students of this University often read English articles.

1

3. This year the students of all the groups of our university

2 3

very often read articles from English scientific journals.

Задача состоит в том, чтобы научиться выделять даже в самых запутанных предложениях основу предложения, которая состоит из подлежащего, сказуемого и дополнения.

Опознавание сказуемого.

Большинство глагольных форм имеет формальные признаки, которыми являются вспомогательные и модальные глаголы. Сказуемое, имеющее при себе явные внешние признаки, называют «явным» сказуемым. «Явное» сказуемое обычно опознается в предложении без труда. Оно само как бы бросается в глаза благодаря своим сигнальным знакам. Кроме «явных» сказуемых, имеются и «неявные» сказуемые, т. е. такие, которые лишены явных формальных признаков. К ним относятся хорошо известные нам формы Present Simple и Past Simple.

Опознавание «неявного» сказуемого выраженного формой Present Simple и Past Simple

1. *Слово без окончания* -*s*. Для того чтобы признать слово без окончания -s глаголом в форме Present Indefinite, нужно убедиться, что это слово занимает второе место после подлежащего — место сказуемого. Доказательством этого должно послужить наличие слева от данного слова подлежащего, которое выражено именем существительным во множественном числе или местоимением, заменяющим его. Между подлежащим и сказуемым может стоять или обстоятельство, выраженное наречием, или правое определение подлежащего. Справа от этого слова могут быть дополнения или обстоятельства. Например:

Most metals **form** oxides.

Слово form—сказуемое предложения; подлежащее— metals, дополнение — oxides.

2. *Слово с окончанием* -*s*. Для опознания слова с окончанием -s глаголом в форме Present Simple, нужно убедиться, что это слово стоит на втором месте в предложении, т. е. после подлежащего.

Доказательство - наличие слева от данного слова подлежащего, которое может быть выражено именем существительным в единственном числе, местоимением, заменяющим его, инфинитивом или герундием. Между подлежащим и сказуемым может стоять или обстоятельство, выраженное наречием, или правое определение подлежащего. Справа от данного слова могут стоять дополнения или обстоятельства. Например:

A bad damage of the equipment often changes the frequency.

Сказуемое — changes; слева от него расположено подлежащее— damage; справа—дополнение the frequency.

3. *Слово с окончанием -ed*. Для того чтобы признать слово с окончанием -ed сказуемым, выраженным глаголом в форме Past Indefinite, нужно убедиться, что это слово занимает в предложении второе место после подлежащего; справа от него обычно следует дополнение:

He heated the solution.

Слово с окончанием -ed может следовать за подлежащим, но не быть сказуемым.

All the instruments **required arrived** in time.

Все необходимые инструменты прибыли вовремя.

Сказуемое— arrived; оно занимает второе место, а слово required является правым определением к подлежащему instruments.

Опознавание явных сказуемых происходит по его первому компоненту. Это — вспомогательный или модальный глагол: am, is, are, was, were, do, does, did, have, has, had, shall, should, will, would, can, could, may, might, must, ought to, need.

Опознавание подлежащего

Для того чтобы научиться опознавать подлежащее, необходимо прежде всего знать, чем оно может быть выражено в английском предложении.

1. Подлежащее может быть выражено именем существительным без предлога, занимающим 1-е место, т. е. расположенным слева от сказуемого.

The pump operates well.	Насос работает хорошо.

Подлежащее, выраженное, существительным, может иметь и левые и правые определения:

The centrifugal pumps of this type operate well.	Центробежные насосы такого типа работают.

В качестве правого определения могут выступать инфинитив или инфинитивный оборот, а также определительные придаточные предложения:

The pump to be installed in our laboratory has been thoroughly tested.	Насос, который будет установлен в нашей лаборатории, прошел все испытания.

2. Подлежащее может быть выражено местоимением

We have analysed the following compounds.	Мы проанализировали следующие вещества.

Местоимение they также может быть подлежащим неопределенно-личного предложения. В этом случае they на русский язык не переводится.

They say we shall have to test the new equipment.	**Говорят,** что нам придется испытывать новое оборудование.

Местоимение it может являться формальным подлежащим безличного предложения:

It is impossible to decompose an element chemically.	Невозможно разложить элемент химическим путём.

3. Подлежащее может быть выражено инфинитивом.

To know foreign languages is very useful.	Знать иностранные языки очень полезно.

4. Подлежащее может быть выражено герундием. Герундий (глагольная форма с суффиксом -ing), занимающий в предложении первое место, является подлежащим.

Swimming in cold water was dangerous for him.	Плавать в холодной воде было для него опасно.

5. Подлежащее может быть выражено придаточным предложением.

Why the engine stopped running was difficult to un derstand.	**Почему двигатель перестал работать,** было трудно понять.

Опознавание дополнений

Дополнение обозначает то лицо или предмет, на который направлено действие, совершаемое лицом или предметом, выраженным подлежащим.

Для того чтобы правильно опознавать дополнения, необходимо твердо помнить следующее:

1) Дополнения расположены справа от сказуемого и занимают третье место в предложении.

2) Дополнения бывают прямые, косвенные и предложные.

3) По способу выражения дополнение может быть простым и сложным.

4) К простым дополнениям относятся такие, которые выражены:

а) личными местоимениями в объектном падеже: me, him, her, it, us, you, them;

б) существительным без предлога;

в) инфинитивом;

г) герундием.

5) К сложным дополнениям относятся такие, которые выражены:

а) объектным инфинитивным оборотом;

б) сложным герундиальным оборотом (герундий с левым определением);

в) дополнительным придаточным предложением.

Опознавание определений

Определения уточняют подлежащее, дополнение и обстоятельство, выраженные существительными, и образуют с ними группы подлежащего, дополнения и обстоятельства.

Определения к именам существительным всегда стоят рядом с ними и могут предшествовать им (левое определение) или следовать за ними (правое определение).

Левое определение обычно выражается прилагательным, числительным, местоимением, а правое — существительным с предлогом (чаще всего of), которое обычно переводится на русский язык существительным в родительном падеже.

Alternating current transformers	трансформаторы **переменного тока**

При переводе группы существительного с левым определением нужно начинать перевод с конца, идя справа налево и устанавливая путем вопросов правильные смысловые отношения между словами:

thermoelectric generator design problem

↓

чего? ← проблема

↓

чего? конструирования ←

↓

какого? ← генератора

↓

термоэлектрического

Перевод: проблема конструирования термоэлектрического генератора.

§ 21. Сокращения (аббревиатуры)

Сокращения широко используются во всех стилях английского языка. Этот структурный тип слов характерен не только для разговорного стиля, но и часто используется в текстах официально-делового и научного стиля, в том числе и в текстах химико-технологической направленности.

Списки сокращений включаются во многие словари. Существуют также и отдельные словари аббревиатур. Однако не все сокращения попадают в словари. Наряду с наиболее часто встречающимися сокращениями, зафиксированными в словарях, некоторые тексты могут содержать окказиональные сокращения. Такие сокращения один раз расшифровываются в тексте и повторно используются в том же тексте уже без расшифровки. Если расшифровка не даётся, значения таких сокращений следует определять по контексту.

Сокращения (аббревиатуры) получили широкое распространение в английском языке в силу тенденции к экономии средств выражения.

§ 22. Обозначение даты в английском языке

30-е МАРТА 2010 г.

- 30 March 2010 (письменная форма)
- the thirtieth of March/March the thirtieth 2010 (устная форма)

Раздел 1

Таблица химических элементов

Таблица химических элементов

Ac Actinium [æk´tınıəm] Актиний

Ag Argentum [ɑ:´dʒentəm] = silver[´sılvə] Серебро

Al Aluminium [ˏælju´mınjəm] Алюминий

Am Americium [əme´rısıəm] Америций

Ar, A Argon [´ɑ:gən] Аргон

As Arsenic [´ɑ:snık] Мышьяк

At Astatium [əs´teıtıəm] Астат(ин)

Au Aurum [´ɔ:rəm] = Gold [gould] Золото

B Boron [´bɔ:rɔn] Бор

Ba Barium [´bεərıəm] Барий

Be Beryllium [bə´rılıəm] Бериллий

Bi Bismuth [´bızməθ] Висмут

Bk Berkelium [bə´:keıljəm] Берк(е)лий

Br Bromine [´broumi:n] Бром

C Carbon [´kɑ:bən] Углерод

Ca Calcium [´kælsıəm] Кальций

Cd Cadmium [´kædmıəm] Кадмий

Ce Cerium [´sıərıəm] Церий

Cf Californium [ˏkælı´fɔ:njəm] Калифорний

Cl Chlorine [´klɔ:ri:n] Хлор

Cm Curium [´kju:rıəm] Кюрий

Co Cobalt [ko´bɔ:lt] Кобальт

Cr Chromium [´kroumıəm] = Chrome [´kroum] Хром

Cs C(a)esium [´si:zıəm] Цезий

Cu Cuprum [´kju:prəm] = Copper [´kɔpə] Медь

Dy Dysprosium [dıs´prouzıəm] Диспрозий

Em Emanation [ˏemə´neıʃən] Эманация

Er Erbium [ˏə:bıəm] Эрбий

Es Einsteinium [aın´staınıəm] Эйнштейний

Eu Europium [juə´roupıəm] Европий

F Fluorine [´fluəri:n] Фтор

Fe Ferrum [´ferəm] = Iron [´aıən] Железо

Fm Fermium [´fə:mjəm] Фермий

Fr Francium [´frænsıəm] Франций

Ga Gallium [´gælıəm] Галлий

Gd Gadolinium [ˌgædə´lınıəm] Гадолиний

Ge Germanium [dʒə:´meınıəm] Германий

H Hydrogen [´haıdrıdʒən] Водород

He Hellum [´hi:ljəm] Гелий

Hf Hafnium [´hα:fnıəm] Гафний

Hg Hydrargium [´haı´dra:dʒırəm] = Mercury [´mə:kjurı] Ртуть

Ho Holmium [´houlmıəm] Гольмий

In Indium [´ındıəm] Индий

Ir Iridium [aı´ri:dıəm] Иридий

J, I Iodine [´aıədi:n] Йод

K Kalium [´kælıəm] = Potassium [pə´tesjəm] Калий

Kr Krypton [´krıptɔn] Криптон

La Lanthanum [´lænθənəm] Лантан

Lw Lawrentium [ˌlɔ:´rentıəm] Лоренций

Li Lithium [´lıθıəm] Литий

Lu Lutecium [lu´ti:ʃıəm] Лютенций

Md Mendelevium [ˌmendə´li:vıəm] Менделевий

Mg Magnesium [mæg´ni:zıəm] Магний

Mn Manganese [ˌməŋgə´ni:z] Марганец

Mo Molybdenum [mə´lıbdınəm] Молибден

N Nitrogen [´naıtrıdʒən] Азот

Na Natrum [´neıtrıəm] = Sodium [´soudjəm] Натрий

Nb Niobium [naı´oubıəm] Ниобий

Nd Neodymium [ˌnıə´dımıəm] Ниодим(ий)

Ne Neon [´ni:ɔn] Неон

Ni Nickel [´nıkl] Никель

No Nobelium [ˌnouˊbi:lıəm] Нобелий (предполагаемое название для элемента 102)

Np Neptunium [nepˊtju:nıəm] Нептуний

O Oxygen [ˊɔksıdʒən] Кислород

Os Osmium [ˊɔzmıəm] Осмий

P Phosphorus [ˊfɔsfərəs] Фосфор

Pa Prot(o)actinium [ˊproutəækˊtınıəm] Протактиний

Pb Plumbum [ˊplΛmbəm] = Lead [led] Свинец

Pd Palladium [pəˊleıdıəm] Палладий

Pm Promethium [prəˊmi:θıəm] Прометий

Pr Praseodymium [ˌprezıəˊdımıəm] Празеодим

Pt Platinum [ˊplætınəm] Платина

Pu Plutonium [plu:ˊtounəm] Плутоний

Ra Radium [ˊreıdıəm] Радий

Re Rhenium [ˊri:nıəm] Рений

Rh Rhodium [ˊroudıəm] Родий

Ru Ruthenium [ru:ˊθınıəm] Рутений

S Sulphur [ˊsΛlfə] Сера

Sb Stibium [ˊstıbjəm] = Antimony [ˊæntıməni] Сурьма

Sc Scandium [ˊskændjəm] Скандий

Se Selenium [sıˊlınjəm] Селен

Si Silicon [ˊsılıkən] Кремний

Sm, Sa Samarium [səˊma:rıəm] Самарий

Sn Stannum [ˊstænəm] = Tin [tın] Олово

Sr Strontium [ˊstrɔnʃıəm] Стронций

Ta Tantalum [ˊtæntələm] Тантал

Tb Terbium [ˊtə:bıəm] Тербий

Tc Technetium [tekˊnıʃıəm] Технеций

Te Tellurium [teˊlju:rıəm] Теллур

Th Thorium [ˊθɔ:rıəm] Торий

Ti Titanium [taıˊteınıəm] Титан

Tl Thallium [ˊθælıəm] Таллий

Tu, Tm Thullium [´θju:lıəm] Тулий

U Uranium [ju´reınıəm] Уран

V Vanadium [və´neıdıəm] Ванадий

W Wolfram(ium) [´wulfrəm] = Tungsten [´tΛŋstən] Вольфрам

Xe Xenon [´zenɔn] Ксенон

Y, Yt Yttirium [´ıtrıəm] Иттрий

Yb Ytterbium [ı´tə:bıəm] Иттербий

Zn Zinc(um) = Zink [zıŋk] Цинк

Zr Zirconium [zə´kounıəm] Цирконий

Для заметок

Раздел 2

Правила чтения элементов, обозначений, формул неорганических соединений и уравнений химических реакций

Правила чтения элементов, обозначений и формул неорганических соединений и уравнений химических реакций

Буквы латинского алфавита, обозначающие название элементов, читаются согласно английским названиям букв алфавита.

Цифра перед обозначением элемента указывает число молекул и читается следующим образом: $2MnO_2$ [ˊtu: ˊmolıkju:lz əv ˊem ˊen ˊou ˊtu:]

Знаки + и -, стоящие в правом верхнем углу, обозначают положительный и отрицательный заряд иона:

H^+- hydrogen ion [ˊhaıdrıdʒən ˊaıən] или univalent positive hydrogen ion [ˊju:nı¸veılənt ˊpɔzətıv ˊhaıdrıdʒən ˊaıən]

Cu^{++}- divalent positive cuprum ion [ˊdaıveılənt ˊpɔzəıv ˊkju:prəm ˊaıən]

Al^{+++}- trivalent positive aluminium ion [ˊtrı:¸veılənt ˊpɔzətıv ¸ælju´mınjəm ˊaıən]

Cl^{-}- negative chlorine ion [ˊnegətıv ˊklɔ:ˊrı:n ˊarən] или negative univalent chlorine ion [ˊnegətıv ˊju:nı ˊveılənt ˊklɔ:ˊrı:n ˊarən]

Знак – или: обозначает одну связь и не читается:

```
              :Ċİ:                  Cl
                                    |
          :Ċİ::Ċ::Ċİ:   или   Cl— C —Cl   [ˊsı:ˊsı:ˊelˊfɔ:]
              :Ċİ:                  |
                                    Cl
```

Знак = или : : обозначает две связи и также не читается:

:Ö::C::Ö: или O=C=O [ˊsı:ˊouˊtu:]

Знак + читается: plus, and или together with

Знак = читается: give или form

Знак → читается: give, pass over to или lead to

Знак ↔ читается: forms или is formed from

Примеры

4KCl [´fɔ: ´mɔlıkju:lz əv ´kei ´si: ´el]

$4HCl + O_2 = 2Cl_2 + 2H_2O$ [´fɔ: ´mɔlıkju:lz əv ´eıtʃ ´si: ´el ´plΛs ´ou ´tu: ´molıkju:lz əv ´si: ´el ´tu: ənd ´tu: ´mɔlıkju:lz əv ´eıtʃ ´tu: ´ou]

$Zn + CuSO_4 = Cu + ZnSO_4$ [´zed ´en ´plΛs ´si: ´ju: ´es ´ou ´fɔ: ´gıv ´si: ´ju: ´plΛs ´zed ´en ´es ´ou: ´fɔ:]

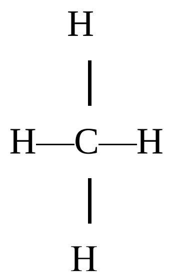
$PCl_3 + 2Cl \rightarrow PCl_5$ [´pi: ´si: ´el ´θri: ´plus ´tu: ´molıkju:lz əv ´si: ´el ´gıv ´pi: ´si: ´el ´faıv]

$H_2 + J_2 \leftrightarrow 2HJ$ [´eıtʃ ´tu: ´plΛs ´dʒeı ´tu: ´fɔ:m ənd α: ´fɔ:md frəm ´tu: ´mɔlıkju:lz əv ´eıtʃ ´dʒeı]

$C_2H_2 + H_2O \rightarrow CH_3CHO$ [´si: ´tu: ´eıtʃ ´tu: ´plΛs ´eıtʃ ´tu: ´ou ´gıv ´si: ´eıtʃ ´θri: ´si: ´eıtʃ ´ou]

$N_2 + 3H_2 \leftrightarrow 2NH_3$ [´en ´tu: ´plΛs ´θri: ´mɔlıkju:lz əv ´eıtʃ ´tu: ´fɔ:m ənd α: ´fɔ:md frəm ´tu: ´mɔlıkju:lz əv ´en ´eıtʃ ´θri:]

$AcOH \leftrightarrow AcO^- + H^+$ [´eı ´si: ´ou ´eıtʃ ´fɔ:mz ənd ız ´fɔ:md frəm ´eı ´si: ´ɔksıdʒən ´aıən ´plΛs ´haıdrıdʒən ´aıən]



[´si: ´eıtʃ fɔ:]

ТАБЛИЦА ВЕЩЕСТВ, СИМВОЛОВ И ФОРМУЛ

Обозначение (символ)	**Вещество**
$3Ca_3(PO_4)_2.CaF_2$	Apatite
Ac	Actinium
Ag	Silver
AgBr	Silver bromide
AgCI	Silver chloride
AgI	Silver iodide
$AgNO_3$	Silver nitrate
Al	Aluminum
$Al\ (OH)_3$	Aluminum hydroxide
AI_2O_3	Aluminum oxide
$AI_2O_3.2H_2O$	Bauxite
$Al_2(SO_4)_3$	Aluminum sulphate
Am	Americium
Ar	Argon
As	Arsenic
At	Astatine
Au	Gold
B	Boron
B_2O_3	Boron oxide
BCI_3	Boron trichloride
Ba	Barium
$BaCI_2$	Barium chloride
Be	Beryllium
Bi	Bismuth
Bk	Berkelium
Br/Br_2	Bromine
-Br	Bromo group
C	Carbon
Обозначение (символ)	**Вещество**
C_2H_4	Ethene
C_2H_5Br	Bromoethane
C_2H_5CHO	Propanal

C_2H_5Cl	Chloroethane
C_2H_5COOH	Propanoic acid
C_2H_5OH	Ethanol
C_2H_6	Ethane
C_3H_4	Propyne
C_3H_6	Propene
C_3H_6O	Propanone
C_3H_7OH	Propan-1-ol
C_3H_8	Propane
C_4H_6	But-1-yne
C_4H_8	But-1-ene
C_4H_9OH	Butan-1-ol
C_4H_{10}	Butane
C_5H_8	Pent-1-ene
C_5H_8	Butane
C_5H_{I2}	Pentane
$C_6H_8O_6$	Ascorbic acid
$C_6H_{12}O_6$	Glucose
C_6H_{14}	Hexane
C_7H_{16}	Heptane
C_8H_{18}	Octane
C_9H_{2O}	Nonane
$C_{12}H_{22}O_{11}$	Sucrose
$C_{17}H_{35}COOH$	Octadecanoic acid
CCI_4	Tetrachloromet hane
CH_2BrCH_2Br	1,2-dibromoethane
CH_2CHCl	Vinyl chloride
Обозначение (символ)	**Вещество**
CH_3CCH	Propyne
CH_3CH_2CCH	But-1-yne
$CH_3CH_2CH_2CH_2OH$	Butan-1-ol
$CH_3CH_2CH_2OH$	Propan-1-ol
CH_3CH_2CHO	Propanal
CH_3CH_2CI	Chloroethane
CH_3CH_2COOH	Propanoic acid

CH_3CH_2OH	Ethanol
CH_3CH_2ONa	Sodium ethoxide
CH_3CHO	Ethanal
$CH_3CHOHCH_3$	Propan-2-ol
CH_3CI	Chloromethane
$CH_3COCH_2CH_3$	Butanone
CH_3COCH_3	Propanone
$CH_3COOCH_2CH_3$	Ethyl ethanoate
CH_3COOH	Ethanoic acid
CH_3NH_2	Methyl amine
CH_3OCH_3	Methoxymetha ne
CH_3OH	Methanol
CH_4	Methane
CHCH	Ethyne
CO	Carbon monoxide
-CO	Carbonyl group
CO_2	Carbon dioxide
-COOH	Carboxyl group
$(COOH)_2$	Ethanedioic acid
$COOH(CH_2)_4COOH$	Hexanedioic acid
Ca	Calcium
$Ca_3(PO_4)_2$	Calcium phosphate
$CaCO_3$	Calcium carbonate
$CaCO_3.MgCO_3$	Dolomite
CaF_2	Fluorospar
Обозначение (символ)	**Вещество**
CaO	Calcium oxide
$Ca(OH)_2$	Calcium hydroxide
$CaSiO_3$	Calcium metasilicate
$CaSO_4$	Calcium sulphate
$CaSO_4.2H_2O$	Cypsum

Cd	Cadmium
Ce	Cerium
Cf	Californium
CI/CI_2	Chlorine
-CI	Chloro group
Cm	Curium
Co	Cobalt
$CoCI_2$	Cobalt(II) chloride
Cr	Chromium
Cs	Caesium
Cu	Copper
Cu_2O	Copper(I) oxide
CuCl	Copper(I) chloride
$CuCI_2$	Copper(II) chloride
$CuCO_3.Cu(OH)_2$	Malachite
$(CuFe)S_2$	Copper pyrites
$(Cu(NH_3)_4)SO_4$	Tetraammine
CuS	Copper(II) sulphate
$Cu(NO_3)_2$	Copper(II) nitrate
$CuSO_4$	Copper(II) sulphate
$CuSO_4.3Cu(OH)_2$	Basic copper sulphate
D	Deuterium
D_2O	Deuterium oxide
Dy	Dysprosium
Обозначение (символ)	**Вещество**
Er	Erbium
Es	Einsteinium
Eu	Europium
F/F_2	Fluorine
-F	Fluoro group
Fe	Iron
Fe_2O_3	Haematite
$Fe_2O_3.xH_2O$	Rust
$FeCI_2$	Iron(II) chloride

$FeCI_3$	Iron(III) chloride
$Fe(OH)_3$	Iron(III) hydroxide
FeS	Iron(II) sulphide
$FeSO_4$	Iron(II) sulphate
Fm	Fermium
Fr	Francium
Ga	Gallium
Gd	Gadolinium
Ge	Germanium
H/H_2	Hydrogen
H_2CO_3	Carbonic acid
H_2O	Water
H_2O_2	Hydrogen peroxide
$\mathbf{H}_2S$	Hydrogen sulphide
$H_2S_2O_7$	Fuming sulphuric acid
H_2SO_3	Sulphurous acid
$\mathbf{H}_2SO_4$	Sulphuric acid
H_3PO_4	Phosphoric acid
HBr	Hydrogen bromide
HCl	Hydrogen chloride/ Hydrochloric acid
HCHO	Methanol
Обозначе-ние (сим-вол)	**Вещество**
HCOOH	Methanoic acid
HI	Hydrogen iodide
HNO_2	Nitrous acid
HNO_3	Nitric acid
He	Helium
Hf	Hafnium
Hg	Mercury
HgS	Cinnabar
Ho	Holmium
I/I_2	Iodine

In	Indium
Ir	Iridium
К	Potassium
K_2CO_3	Potassium carbonate
$K_2Cr_2O_7$	Potassium dichromate
K_2SO_4	Potassium sulphate
$K_2SO_4.AI_2(SO_4)_3$	Aluminium potassium sulphate-12-water
KBr	Potassium bromide
KCl	Potassium chloride
KI	Potassium iodide
$KMnO_4$	Potassium permanganate
KNO_3	Potassium nitrate
KOH	Potassium hydroxide
Kr	Krypton
KrF_2	Krypton fluoride
La	Lanthanum
La_2O_3	Lanthanum oxide
Li	Lithium
Li_3N	Lithium nitride
LiCl	Lithium chloride
LiOH	Lithium hydroxide
Lr **or** Lw	Lawrencium
Lu	Lutetium
Md	Mendelevium
Mg	Magnesium
$MgCI_2$	Magnesium chloride
$MgCO_3$	Magnesium carbonate
MgO	Magnesium

	oxide
$Mg(OH)_2$	Magnesium hydroxide
$MgSO_4$	Magnesium sulphate
Mn	Manganese
$MnCI_2$	Manganese (IV) chloride
MnO_2	Pyrolusite/ Manganese (IV) oxide
Mo	Molybdenum
N/N_2	Nitrogen
N_2O	Dinitrogen oxide
N_2O_4	Dinitrogen tetraoxide
$-NH_2$	Amino group
$NH_2(CH_2)_6NH_2$	1,6-diaminohexane
NH_3	Ammonia
$(NH_4)_2SO_4$	Ammonium sulphate
NH_4Cl	Ammonium chloride
NH_4OH	Ammonia solution
NH_4NO_3	Ammonium nitrate
NO	Nitrogen monoxide
NO_2	Nitrogen dioxide
Na	Sodium
Na_2CO_3	Sodium carbonate
$Na_2CO_3.10H_2O$	Washing soda
Na_2SO_3	Sodium sulphite
Na_2SO_4	Sodium sulphate
Na_3AIF_6	Cryolite
$NaAI(OH)_4$	Sodium aluminate
NaBr	Sodium bromide

NaCI	Sodium chloride
NciCIO,	Sodium chlorate
$NaHCO_3$	Sodium hydrogencarbonate
NaHSO,	Sodium hydrogensulphate
$NaIO_3$	Sodium iodate
$NaNO_2$	Sodium nitrite
$NaNO_3$	Sodium nitrate
NaOCl	Sodium hypochlorite
NaOH	Sodium hydroxide
Nb	Niobium
Nd	Neodymium
Ne	Neon
Ni	Nickel
NiS	Nickel sulphide
No	Nobelium
Np	Neptunium
O/O_2	Oxygen
O_3	Ozone
-OH	Hydroxy1 group
Os	Osmium
OsO_4	Osmium tetroxide
P	Phosphorus
P_2O_s	Phosphorus pentoxide
Pa	Protactinium
Pb	Lead
Pbl_2	Lead(II) iodide
$Pb(NO_3)_2$	Lead(II) nitrate
PbO	Lead(II) oxide
PbO_2	Lead(IV) oxide
$Pb(OC_2H_5)_4$	Tetraethyl-lead
$Pb(OH)_2$	Lead(ll) hydroxide
PbS	Galena
Pd	Palladium

Pm	Promethium
Po	Polonium
Pr	Praseodymium
Pt	Platinum
Pu	Plutonium
Ra	Radium
Rb	Rubidium
Re	Rhenium
Rh	Rhodium
Rn	Radon
Ru	Ruthenium
S	Sulphur
SO_2	Sulphur dioxide
SO_3	Sulphur trioxide
Sb	Antimony
Sc	Scandium
Se	Selenium
Si	Silicon
SiO_2	Silicon dioxide
Sm	Samarium
Sn	Tin
Sr	Strontium
T	Tritium
Ta	Tantalum
Tb	Terbium
Tc	Technetium
Te	Tellurium
Th	Thorium
Ti	Titanium
Tl	Thallium
Tm	Thulium
U	Uranium
V	Vanadium
V_2O_5	Vanadium pentoxide
W	Tungsten
Xe	Xenon
$XeFe_4$	Xenon tetrafluoride
Y	Yttrium
Yb	Ytterbium
Zn	Zinc

$ZnCI_2$	Zinc chloride
$ZnCO_3$	Calamine
ZnO	Zincite/ Zinc oxide
$Zn(OH)_2$	Zinc hydroxide
Zn(OH)CI	Basic zinc chloride
ZnS	Zinc blende
$ZnSO_4$	Zinc sulphate
Zr	Zirconium

Прочитайте по-английски уравнения химических реакций:

Образец:

2CaCO3 = 2CaO + 2O2

['tu: 'molikju:lz əv si ei 'si:'əụ' θri: 'givz 'tu: 'molikju:lz əv 'si:'ei əụ 'pl^s 'tu: 'molikju:lz əv 'əụ'tu:]

1) 2Mg + Si = Mg2Si

2) 2NO + O2 = 2NO2

3) 3MnO2 + 2 Al = 2 AlO3 + 3Mn

4) 4KClO3 = 3KClO4 + KCl

5) 2TeClO3 = TeCl4 + Te

6) MnO2 + RH2S = MnS + S + 2H2O

7) 6HClO4 + P2O5 = 3Cl2O7 + 2H3PO4

8) K2Se + H2O = KSeH + KOH

9) 4FeCr2O4 + 8NaCO3 + 7O2 = 8Na2CrO4 + 2Fe2O3 + 8CO2↑

10) KIO3 + Cl2 + 6KOH = K5IO6 + 2KCl + 3H2O

11) NaBrO3 + F2 + 2NaOH = NaBrO4 + 2NaF + H2O

12) 2KMnO4 + 2Na2SO3 + 4NaOH = 2Na3MnO4+Na2SO4+K2SO4+ 2H2O

Математические и некоторые другие знаки выражения

\+ plus

\- minus

x or · multiplication sign

3 × 5 = 15 three times five, fifteen

ab a times b

/ or : division sign

m/s meter per second? Meter a second

: ratio sign (знак отношения, например, в пропорциях)

a/b	a over b
a/2	half a
=	sign of equality
$a + b = c$	*a* plus *b* equals *c* or (is equal to c)
$a \neq c$	*a* is not equal to *c*
$a \approx c$	*a* is approximately equal to *c*

$(a + b)^2$	*a* plus *b*, squared
< *or* >	is smaller (greater) than
≤ *or* ≥	is smaller (greater) than or equal to
∞	infinity sign
a^*	*a* star
[ ]	brackets, square brackets
( )	parentheses, round brackets
{ }	braces
||	parallel to
| *x* |	absolute value of x
°	degree
'	1) minute; 2) foot
"	2) second; 2) inch
∠	angle
⊥	perpendicular
$\sqrt{x}$	square root of *x*, root *x*
$\sqrt[3]{a}$	cube root of a
$\sqrt[n]{x}$	^{n}th root of x
$x^2(x^3)$	*x* squared, *x* cube
x^n	*x* to the power *n*, *x* to the *n*
x°	*x* nought
x^1	*x* sub one, *x* first
*x*i	*x* ith, *x* subscript *i*, *x* sub *i*
1/*x*	one over *x*
$x'(x'',x''')$	*x* prime (double or second prime or double dashed, triple or third prime)
x'1	*x* first prime
x'1	*x* sub *i* prime, *xi*-th prime
ℓg *x*, log *x*	decimal logarithm of x (Brigg's logarithm, logarithm to the base ten)
ln *x*	natural logarithm of x (naperian logarithm, logarithm to the base e)

$f(x)$	f of x
$\sum_{0}^{\infty} ai$	sum of a over i from 0 to infinity
dx	differential of x
dy/dx	dy by dx, derivative of y with respect to x
$d^n y/dx^n$	n-th derivative of y with respect to x
$\int f(x)dx$	integral of the f of x dx
sin x (cos x)	sine (cosine) of x
tan x (tg x)	tangent of x
ctn x, ctg x	cotangent of x
sec x	secant of x
csec x, csc x	cosecant x
arcsin x	inverse sine of x
sinh x	hyperbolic sign of x
2/5	two fifth
0.16	point sixteen
3.25	three point twenty five
3×10^{13}	three by ten to the thirteen
˚C	degree centigrade, degree Celcius, degree C
@	(commercial) at

Для заметок

Раздел 3

Правила чтения единиц измерения

Правила чтения единиц измерения

Physical quantities are such things as **mass** and **current,** which are used in all the sciences. They all have to be measured in some way and each therefore has its own **unit.** These are chosen by international agreement and are called **International System** or **SI units** - abbreviated from the French Systeme International d'Unites. All quantities are classified as either **basic quantities** or **derived quantities.**

Basic quantities

A set of quantities from which all other quantities (see **derived quantities)** can be defined (see table, below). Each basic quantity has its **basic SI unit,** in terms of which any other SI unit can be defined.

Basic quantity	Symbol	Basic SI unit	Abbreviation
Mass	*m*	kilogram	*kg*
Time	*t*	second	*s*
Length	*L*	meter	*m*
Current	*C*	ampere	*A*
Temperature	*T*	kelvin	*K*
Quantity of substance	-	mole	*mol*
Luminous intensity	-	candela	*cd*

Prefixes

A given SI unit may sometimes be too large or small for convenience, e.g. the metre is too large for measuring the thickness of a piece of paper. Standard fractions and multiples of the SI units are therefore used and written by placing a prefix before the unit (see table below). For example, the millimetre (mm) is equal to one thousandth of a metre.

Fractions and multiples in use

Fraction or multiple	Prefix	Symbol
10^{-9}	nano-	*n*
10^{-6}	micro-	*μ*
10^{-3}	milli-	*m*
10^{-2}	centi-	*c*
10^{-1}	deci-	*d*
10^{1}	deca-	*dc*
10^{2}	hecto-	*h*
10^{3}	kilo-	*k*
10^{6}	mega-	*M*
10^{9}	giga-	*G*

Basic SI units

Kilogram (kg)

The SI unit of mass. It is equal to the mass of an international prototype metal cylinder kept at Sevres, near Paris.

Second (s)

The SI unit of time. It is equal to the duration of 9,192,631,770 **periods*** of a certain type of radiation emitted by the caesium-133 atom.

Metre (m)

The SI unit of length. It is equal to the distance light travels in a vacuum in 1/299,792,458 of a second.

Ampere (A)

The SI unit of electric current (see also page 60). It is equal to the size of a current flowing through parallel, infinitely long, straight wires in a vacuum that produces a force between the wires of 2 x 10^{-7}N every metre.

Kelvin (K)

The SI unit of temperature. It is equal to 1/273.16 of the temperature of the **triple point** of water (the point at which ice, water and steam can all exist at the same time) on **the absolute temperature scale**.

Mole (mol)

The SI unit of the quantity of substance (note, that this is different from mass, because it is the number of particles of a substance). It is the equal to the amount of substance which contains $6.023\ 10^{23}$ (this is **Avogadro's number**) particles (e.g. atoms or molecules.)

Candela (cd)

The SI unit of intensity of light. It is equal to the strength of light from 1/600,000 square metres of a totally black object at the temperature of freezing platinum and at pressure of $101{,}32 N\ m^{-2}$.

Раздел 4

Наименования основных химических соединений

Наименования основных химических соединений

Simple organic compounds (those with one or no functional group) can be named by following Stages 1 and 2.

В таблице представлены префиксы, используемые в зависимости от числа атомов углерода в цепи.

Количество атомов водорода в цепи	Префикс
один	meth-
два	eth-
три	prop-
четыре	pint-
пять	pent-
шесть	hex-
семь	hept-
восемь	oct-

Stage 1

Choose the sentence from a) to i) which describes the unidentified molecule, then go to the Stage 2 number indicated.

a) The molecule contains only carbon and hydrogen atoms and ***single bonds*****.* Go to 1

b) The molecule contains only carbon and hydrogen atoms and a ***double bond*****.* Go to 2

c) The molecule contains only carbon and hydrogen atoms and a ***triple bond*****.* Go to 3

d) The molecule contains carbon, hydrogen and a ***hydroxyl group (-OH).*** Go to 4

e) The molecule contains carbon, hydrogen and a ***–CHO group*** *at one end.* Go to 5

f) The molecule contains carbon, hydrogen and a ***carbonyl group (-CO-)*** *between two carbons in the carbon chain.* Go to 6

g) The molecule contains carbon, hydrogen and ***carboxyl group (-COOH).*** Go to 7 *h) The molecule contains only carbon and hydrogen, but has a* ***side chain*****.*

Go to 8

i) The molecule contains carbon, hydrogen and one or more ***halogen**** *atoms.*

Go to 9

Key to atoms

 Hydrogen atom

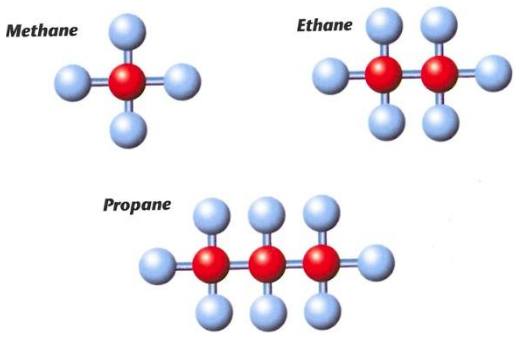
 Carbon atom

Other atoms as named

Stage 2

1. The name of a molecule that contains only carbon and hydrogen atoms joined by **single bonds** begins with the prefix for the number of carbons (see prefix chart, left) and ends in –**ene**.

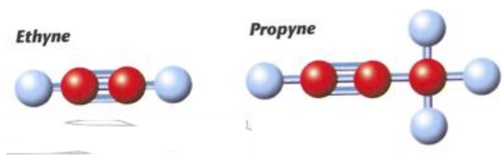
For example:



These molecules are all ***alkenes****.*

2. The name of a molecule that contains only carbon and hydrogen atoms and has one triple bond begins with the prefix for the number of carbons (see prefix chart, left) and ends in –yne.

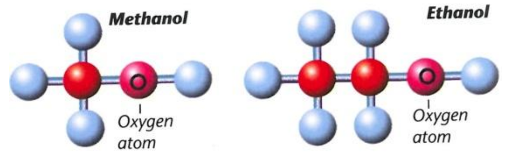
For example:



These molecules are all ***alkynes****.*

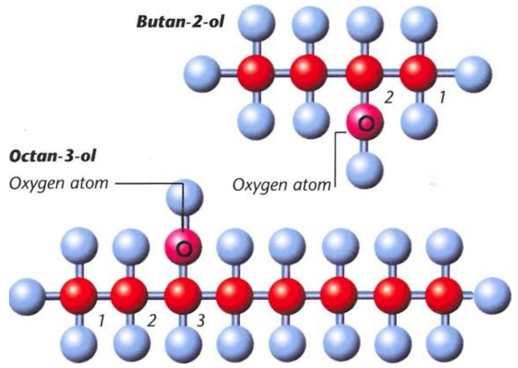
3a. The name of a molecule that contains only carbon and hydrogen atoms and has one hydroxyl group (-OH) begins with the prefix for the number of carbons (see prefix chart, left) and ends in –ol.

For example:



3b. If the **–OH group** is not at one end of the molecule, the number of the carbon to which it is attached is given in front of the name. The carbon atoms are always numbered from the end of the molecule closest to the –OH group.

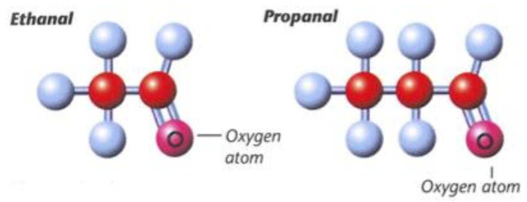
For example:



*All molecules in sections **4a** and **4b** are **alcohols**.*

4. The name of a molecule that contains only carbon and hydrogen atoms and has a **–CHO group** ending the chain begins with the prefix for the number of carbons and ends in **–al**. For example:

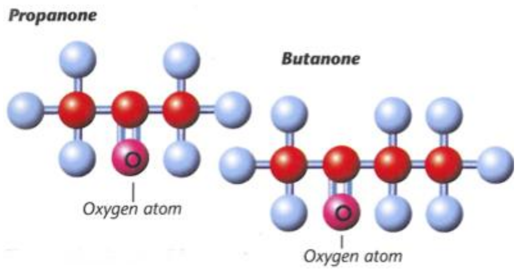
For example:



*These molecules are all **aldehydes**.*

5. The name of a molecule that contains only carbon and hydrogen atoms and has a **carbonyl group (-CO-)** between the ends of the carbon chain, begins with the prefix for the number of carbons and ends in **–one**.

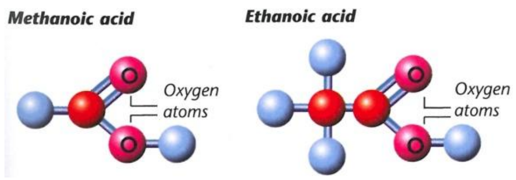
For example:



*These molecules are all **ketones**.*

6. The name of a molecule that contains only carbon and hydrogen atoms and one **carboxyl group (-COOH)** begins with the prefix for the number of carbons and ends in **–oic acid**.

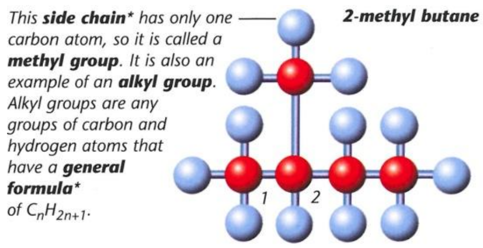
For example:



*These molecules are all **carboxylic acids**.*

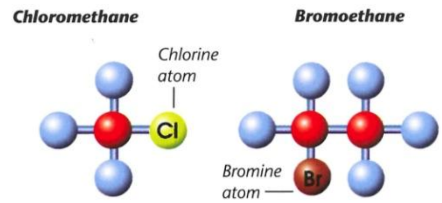
7. The name of a branched molecule begins with the name of the branch **(side chain)**. If this has only carbon and hydrogen atoms, its name begins with the prefix for the number of carbons in its chain and ends in **–yl**. The main chain is named afterwards in the normal way.

For example:



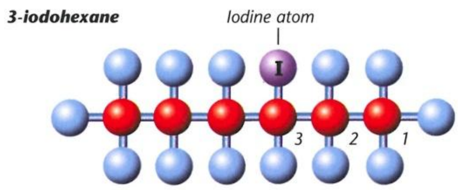
The figure at the beginning of the name gives the number of the carbon atoms to which the side chain is joined. The carbon atoms are always numbered from the ends of the chain closest to the branch.

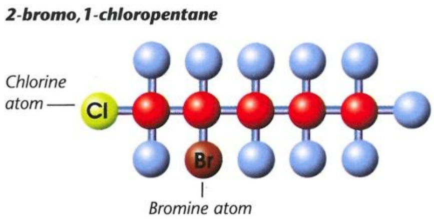
8. The name of a molecule that contains only carbon and hydrogen atoms and one or more halogens begins with the abbreviation for the halogen(s). (They are listened in the alphabetical order if more than one.) The abbreviations for bromine, chlorine, fluorine and iodine are bromo, chloro, fluoro and iodo respectively.



The end of the name is that which the molecule would have had if all the halogen atoms had been replaced by hydrogen atoms. With molecules of three carbon atoms or more, the name includes the number of the carbon atom to which the halogen is attached. The carbon atoms are always numbered from the end of the chain closest to the halogen(s).

For example:





*All molecules in section **9** are **halogenoalkanes**.*

Раздел 5

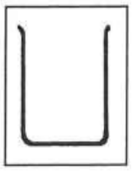
Перечень наименований основного химического оборудования

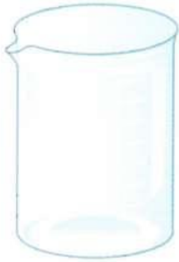
Перечень наименований основного химического оборудования

Наиболее распространенные части химического аппарата описаны и прилюстрированы. Простые 2-D диаграммы используются для схематичного показа оборудования.

Beaker

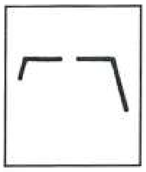
Used to hold liquids. Shows approximate volume. Possible capacities: 5-5, 000 ml





Beehive shelf

Used to support a gas jar while gas is being collected by the displacement of water.



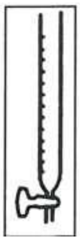
Bunsen burner

Used to provide heat for chemical reactions. Its adjustable air-hole allows some control of the flame temperature. If the hole is closed, the flame is yellow and cooler than the blue flame produced when the hole is open.

Burette

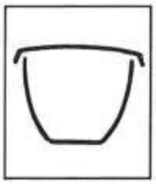
Used to add accurate volumes of liquid during titrations (see volumetric analysis**).**

Possible capacities: 10-100 ml



Crucible

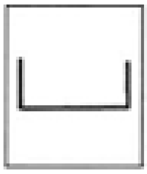
Used to hold small quantities of solids which are being heated strongly, either in a furnace or over a bunsen burner. They are made of porcelain, silica, fireclay, nickel or steel.




Possible diameters: 2.5-5.5cm

Crystallizing dish

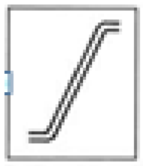
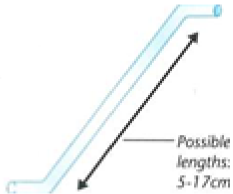
Used to hold solutions which are being evaporated to form crystals. The flat bottom helps to form an even layer of crystals.




Possible capacities: 100-2,000ml

Delivery tube

A tube used to carry gases.

Filter paper

Paper which acts as a sieve, only allowing liquids through, but no solid matter. Filter paper is graded according to how finely it is meshed, i.e. the size of particle it allows through. It is put in a filter or Buchner funnel to give support as the liquid passes through, and the solid settles on the paper.

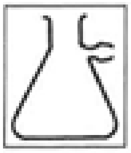
Mesh of fine filter paper, magnified many times.

Mesh of coarse filter paper, magnified many times. Holes between fibres allow tiny particles to pass through.

Buchner flask

Used when liquids are filtered by suction.

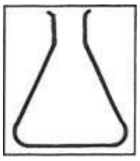
Possible capacities: 250-1,000ml



Conical flask

Used to hold liquids when carrying out reactions and preparing solutions of known concentration. They are used in preference to beakers when it is necessary to have a container that can be stoppered. They have some volume markings but these are not as accurate as the markings on a pipette or burette

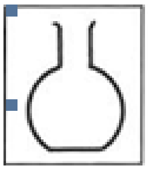
Possible capacities: 25-2,000ml



Flat-bottomed flask

Used to hold liquids when carrying out reactions where heating is not required (the flask stands on the workbench

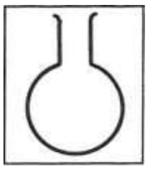
Possible capacities: 100-2,000ml



Round-bottomed flask

Used to hold liquids, especially when even heating is needed. Volume markings are approximate. It is held in position above

Possible capacities: 100-2,000ml



Volumetric flask

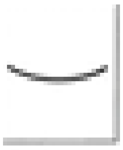
Used when mixing accurate concentrations of solutions. Each flask has a volume marking which is very exact and a stopper so that it can be shaken to mix the solution.

Possible capacities: 10-2,000ml

Evaporating basin

Used to hold a solution whose solvent is being separated from the solute by evaporation (often using heat).

Possible capacities: 50-500ml

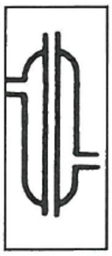


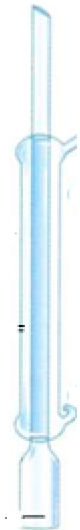
Dessicator

A glass container uses to dry solids. It contains a drying agent.

Liebig condenser

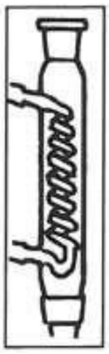
Used to condense vapours. Vapour passes through the central channel and is cooled by water flowing through the outer pipe.

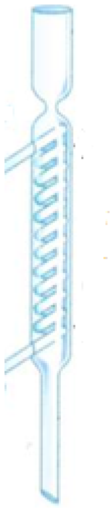




Reflux condenser

Used to return vapour to a liquid to prevent loss by evaporation





Fractionating column

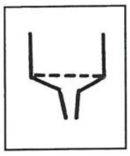
Used to separate components of a mixture by their boiling points. It contains glass balls or rings that provide a large surface area and thus promote condensation and re-evaporation.

Possible lengths:15-36 cm

Buchner funnel

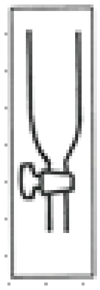
Used when liquids are filtered by suction. It has a flat, perforated plate, on which filter paper is placed.

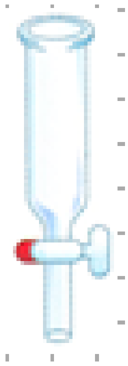
Possible capacities: 50-500ml



Tap funnel

For adding a liquid to a reaction mixture drop by drop.

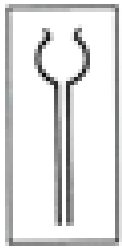
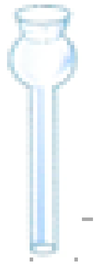




Thistle funnel

Used when adding a liquid to a re-action mixture.

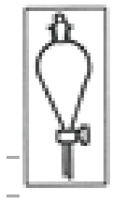
Length: 30cm

Separating funnel

Used when separating immiscible liquids. First the denser liquid is run off, then the less dense.

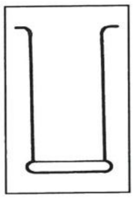
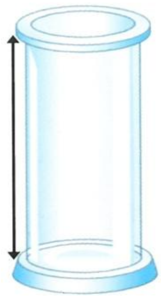
Possible capacities: 50-500ml




Gas jar

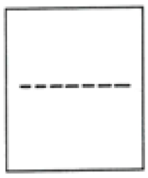
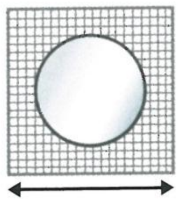
Used when collecting and storing gases. The jar can be sealed using a glass lid whose rim is coated with a thin layer of grease.Possible heights:

15-30cm

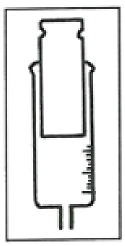
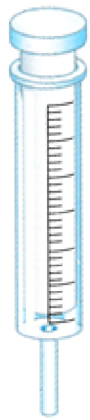
Gauze

Used to spread the heat from a flame evenly over the base of an ob-ject being heated. Made of iron, steel, copper or ceramics.

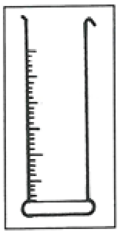
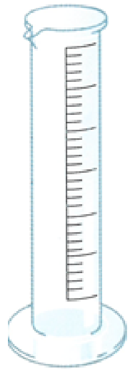



Fume cupboard

A glass panelled cupboard that con-tains an extractor fan and encloses an area of workbench. Dangerous experiments are carried out in a fume cupboard.

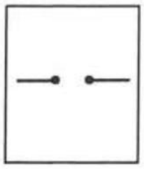
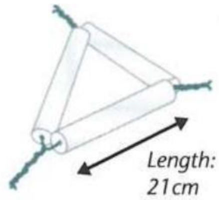
Measuring cylinder

Used to measure the approximate volume of liquids.

Possible capacities: 5-2,000ml

Pipeclay triangle

Used to support crucibles on tripods when they are being heated. They are made of iron or nickel-chromium wire enclosed in pipeclay tubes.

Pipettes

Pipette


Used to dispense accurate volumes of liquid. They come in different sizes for different volumes. The liquid is run out of the pipette until its level has dropped from one volume marking to the next.

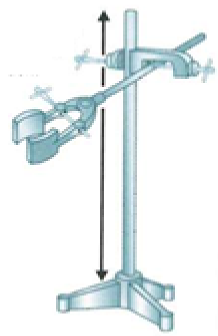
Possible capacities: 1 - 100m

Dropping pipette or teat pipette


Used to dispense small volumes or drops of liquid. It does not provide an accurate measurement.

Possible capacities: 1-2 ml

Stands and clamps



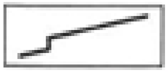
Used to holdapparatus, e.g. round-bottomed flasks, in position.

Possible length 50-100cm

Spatula

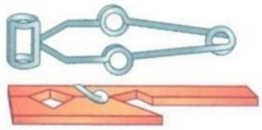
Used to pick up small quantities of a solid.

Possible lengths: 10-20cm



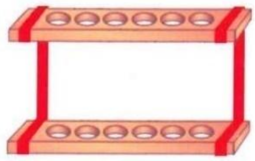
Test tube holder

Used to hold a test tube, e.g. when heating it in a flame, creating a chemical reaction



Test tube rack

Used to hold many test tubes upright.

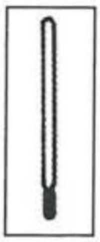


Thermometer

Used to measure temperature. They are filled either with alcohol or with mercury, depending on the temperature range for which they are intended.

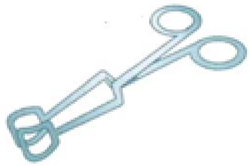
Small temperature range:-10 to 50°C

Large temperature range: -10 to 400°C



Tongs

Used to move hot objects.

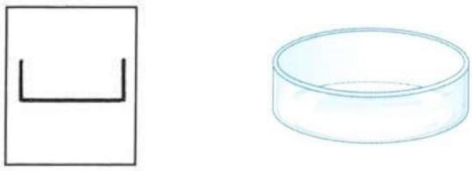


Top pan balances

Used for quick, accurate weighing.

Trough

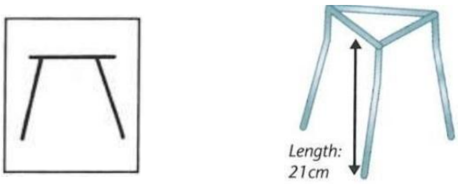
Used when collecting gas over water (see carbon dioxide, page 102). The water contained in a gas jar inverted in the trough is displaced into the trough. Troughs are also used when substances such as potassium are reacted.



Possible diameters: 20-30cm.

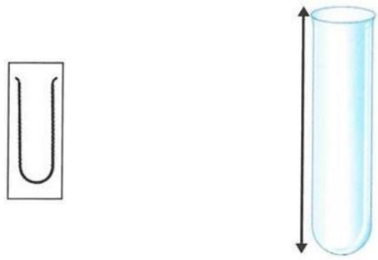
Tripod

Used with a pipeclay triangle or gauze when heating crucibles, flasks, etc.



Boiling tube

A thick-walled tube used to hold substances being heated strongly.



Possible length: 12.5cm

Test tube

A tube used to hold substances for simple chemical reactions not involving strong heating.

Possible length: 7.5cm

Ignition tube

A disposable tube used to hold small quantities of substances being melted or boiled.

Possible length: 5.0

Watch glass

Used when evaporating small quantities. Possible diameters: 5-15cm

Глоссарий

СЛОВАРЬ

А

ability *n* способность, умение
able *a* способный
abnormal *a* неправильный
abolish *v* упразднять
about *adv* приблизительно, примерно
above *adv* над
abrade *v* шлифовать; стирать
abrasion *n* абразия, истирание; шлифовка
abrasive *n* абразив
abrasive-wear *n* износ
abrupt *a* крутой, обрывистый
abruption *n* разрыв; крутизна
absence *n* отсутствие
absent *a* отсутствующий
absolute *a* абсолютный
absorb *v* поглощать
absorbent *n* абсорбент
absorbent carbon активированный уголь
absorber *n* поглотитель; амортизатор
absorbing tower поглотительная башня
absorbit *n* активированный уголь
absorption *n* поглощение
absorption band полоса спектра поглощения
absorption factor коэффициент поглощения
absorptive power поглотительная способность
abstract *v* отщеплять
abstraction *n* отвод; абстрагирование; отщепление
abundance *n* избыток, изобилие
abundant *a* распространенный; обильный
accelerant *n* ускоритель, катализатор
accelerate *v* ускорять
acceleration *n* ускорение
accelerator *n* ускоритель
accept *v* принимать
acceptor *n* акцептор
accessory *a* побочный;вспомогательный
accidental *a* случайный; побочный
accommodate *v* размещать
accommodation *n* аккомодация
accompany *v* сопровождать
accomplish *v* завершать, выполнять; достигать
accomplishment *n* выполнение, завершение
accord *n* согласие; соответствие
accordance *n* соответствие
according to *prep* в соответствий с
accordingly *adv* соответственно
account *n* изложение; счет; расчет
account for *v* пояснять, объяснять
accumulate *v* накапливать
accumulation *n* накапливание; скопление
accumulator *n* аккумулятор
accuracy *n* точность, тщательность
accurate *a* точный, тщательный
acetate *n* ацетат, соль или эфир уксусной кислоты
acetate silk ацетатный шелк
acetic *a* уксусный
acetify *v* превращать в уксус
acetone *n* ацетон
acetyl *n* ацетил

acetylene *n* ацетилен
achieve *v* достигать
achievement *n* достижение
acid *n* кислота
acid base catalysis кислотно-основной катализ
acid bath кислая ванна
acid dye кислотныйкраситель
acid ester кислый эфир
acid extraction извлечение кислотой
acid resistance кислотостойкость
acid treatment обработка кислотой
acidic *a* кислотный
acidifier *n* подкисляющее вещество
acidify *v* подкислять
acidity *n* кислотность
acknowledge *v* признавать; подтверждать
acylic resin акриловая смола
act *v* действовать
actinic *a* актиничный
actinism *n* светочувствительность; актиничность
actinium *n* актиний
action *n* действие
activate *v* активировать
activation *n* активация
activation energy энергия активации
activator *n* активатор
active *a* активный
activity *n* активность
actual *a* действительный, фактический
actually *adv* фактически
acylation *n* ацилирование
adapt *v* приспосабливать
adaptation *n* адаптация
adaptor *n* адаптор, держатель
add *v* прибавлять, добавлять
addition *n* добавление, добавка, прибавление
addition reaction реакция присоединения
additional *a* дополнительный
additive *a* аддитивный
additives *n* присадки
additivity *n* аддитивность
adduct *n* продукт присоединения, аддукт
adequacy *n* пригодность, соответствие
adequate *a* соответствующий, адекватный
adhere *v* прилипать
adherence *n* прилипание
adhesion *n* адгезия, прилипание
adhesive *a* липкий, клейкий
adipic acid адипиновая кислота
adipinic acid адипиновая кислота
adjacent *a* соседний, смежный
adjoin *v* соприкасаться, примыкать
adjust *v* регулировать
adjustment *n* установка, регулирование
administer *v* вводить
administration *n* введение
admissible *a* допустимый
admission *n* допущение
admit *v* допускать
admix *v* примешивать
admixture *n* примесь
adopt *v* принимать
adsorb *v* адсорбировать
adsorbent *n* адсорбент, адсорбирующее вещество
adsorber *n* адсорбер, поглотитель
adsorption *n* адсорбция
adsorption film адсорбционная пленка
advance *v* выдвигать

advantage *n* преимущество
advantageous *a* выгодный
adverse *a* противоположный
aerated water газированная вода
aerial *a* воздушный
aerosol я аэрозоль
affair *n* дело
affect *v* влиять, воздействовать
affinity *n* сродство, сходство
affirm *v* утверждать, подтверждать
afford *v* давать, приносить
afterproduct *n* низший, вторичный продукт
again *adv* опять, снова, кроме того
against *prep* против, относительно
agaric acid агарициновая кислота
age *n* век; возраст; *v* стареть
ageing *n* старение
agent *n* агент; средство; реактив
agglomerate *n* агломерат; *v* слипаться
agglomeration *n* агломерация; скопление
aggregate *n* совокупность
aggregation *n* агрегация
aggressive water вода, содержащая коррозионное вещество
agitate *v* взбалтывать, мешать
agitation *n* перемешивание
agitator *n* мешалка
agree *v* совпадать, соответствовать
agreement *n* соответствие
aid *n* помощь
aim *n* цель
air *n* атмосфера, воздух
aircraft *n* самолет
air bath воздушная ванна
air blast дутье, воздушное дутье
air blower воздуходувка
air chamber воздушная камера
air-cooled с воздушным охлаждением
air duct воздухопровод
airfree *a* безвоздушный
air operated пневматический
air-proof *a* воздухонепроницаемый
airless *a* безвоздушный
air-tight *a* воздухонепроницаемый
albumen *n* белок яйца
albumin *n* альбумин
albuminoid *a* белковый; *n* альбуминоид
alchemist *n* алхимик
alchemy *n* алхимия
alcohol *n* спирт
alcohol ester сложный эфир
alcohol ether простой эфир
alcoholate *n* алкоголят
alcoholic *a* спиртовой
alcoholic extract спиртовая вытяжка
aldehyde *n* альдегид
align *v* выравнивать
alignment *n* выравнивание
alike *a* похожий, одинаковый
aliphatic *a* алифатический
aliphatic hydrocarbon углеводород алифатического ряда
alive *a* живой
alkali *n* щелочь
alkali resistance щелочестойкость
alkali works содовый завод
alkaline *a* щелочной
alkaline-earth *a* щелочноземельный
alkaline metal щелочноземельный металл
alkane *n* алкан
allotropic *a* аллотропный

allotropy *n* аллотропия
allow *v* позволять, допускать
allowance *n* допущение
alloy *n* сплав
alloy steel легированная сталь
along with *adv* вместе, наряду с
alpha-particle *n* альфа-частица
alter *v* изменять
alternate *a* переменный
alternating current переменный ток
alternative *a* возможный *(из двух)*
alternatively *adv* выборочно, переменно
alum *n* квасцы
alumina *n* глинозем, окись алюминия
aluminate *n* алюминат, глиноземное соединение
aluminic dust алюминиевая пыль
aluminum *n амер.* алюминий
amber acid янтарная кислота
americium *n* америций
amic acid аминовая кислота
amide *n* амид
amide wax амидный воск
amine *n* аммиак; амин
amino acetic acid аминоуксусная кислота
ammonia *n* аммиак
ammonia ash аммиачная сода
ammonia bisulphate бисульфат аммония
ammoniac *a* аммиачный
ammonium cyanate цианокислый аммоний
ammonium nitrate аммиачная селитра
amorphism *n* некристалличность
amorphous *a* аморфный; некристаллический
amount *n* сумма; количество
amount to *v* равняться, доходить до, составлять
amphoteric *a* амфотерный
analog *n* аналог
analogous *a* аналогичный
analogy *n* аналогия
analyze *v* анализировать
analysis *n* анализ
analyst *n* аналитик; химик-лаборант
analytical *a* аналитический
ancient *a* старый, дренний
angle *n* угол
angular *a* угловой
anhydride *n* ангидрид (кислоты)
anhydrite *n* ангидрит
anhydrous *a* безводный
aniline *n* анилин
aniline-dye *n* анилиновый краситель
animal *a* животный
animal charcoal животный уголь
animal fat животный жир
anion *n* анион
anion acid анионная кислота
anion exchange анионный обмен
anion exchange resin анионообменная смола
anneal *v* отжигать; прокаливать
annealing *n* отжиг, прокаливание
annelation *n* аннелирование
annular *a* кольцевой
anode *n* анод
anodic coating анодное покрытие
anodic oxidation анодное окисление
anodic treatment анодная обработка
anomalous *a* аномальный
another *pron* другой
anthracene *n* антрацен
anthracite *n* антрацит

anticoagulant *n* противосвертывающее вещество
anti-corrosive *a* антикоррозийный
antifreeze *n* антифриз
antimonic acid сурьмяная кислота
antimony *n* сурьма
antiparticles *n* античастицы
antioxidant *n* антиокислитель
apparatus *n* агрегат; аппаратура; прибор
apparent *a* очевидный; кажущийся
appear *v* казаться; появляться
appearance *n* появление; возникновение; внешний вид
appendix *n* добавление
appreciate *v* оценивать; ценить
applicable *a* применимый
applicant *n* абитуриент, претендент
application *n* применение
applied chemistry прикладная химия
apply *v* применять
appreciable *a* заметный
approach *n* метод; подход; *v* приближаться
appropriate *a* подходящий, соответствующий
approximate *a* приближенный; примерный
approximation *n* приближение, приближенность
aqua regia царская водка
aqueous *a* водный
arbitrary *a* произвольный
arc *n* дуга
architecture *n* архитектура
area *n* площадь, участок
argen turn *n* серебро
argon *n* аргон
arid *a* безводный
arise *v* возникать
armoured glass армированное стекло
aromatic *a* ароматический
aromatic oil ароматическая нефть
aromatic series ароматический ряд
arrange *v* располагать
arrangement *n* расположение
array *n* порядок
arrest *v* задерживать
arrow *n* стрелка
arsenic *n* мышьяк
arsenic acid мышьяковая кислота
art *n* искусство, умение
article *n* изделие
artificial *a* искусственный
asbestos *n* асбест
ascend *v* подниматься
ascertain *v* устанавливать
ash *a* беззольный
asphalt *n* асфальт, битум
assemble *v* монтировать, собирать
assembly *n* агрегат
assign *v* назначать, определять
assignment *n* назначение
assist *v* способствовать
assistance *n* помощь
associate *v* соединять
association *n* объединение
assume *v* допускать, предполагать
assumption *n* предположение, допущение
asymmetric *a* асимметричный
asymmetry *n* асимметрия
atmosphere *n* атмосфера
atmospheric *a* атмосферный
atom *n* атом

atom-smasher *n* ускоритель ядерных частиц
atomic energy атомная энергия
atomicity *n* атомность
atomize *v* распылять жидкость; атомизировать
attach to *v* придавать; присоединять
attachment *n* присоединение, приспособление
attack *n* атака; воздействие; *v* воздействовать
attain *v* достигать
attainment *n* достижение
attempt *n* попытка; *v* пытаться
attend *v* сопровождать
attention *n* внимание
attenuate *v* разбавлять
attenuation *n* разбавление; разжижение
attract *v* притягивать
attraction *n* притяжение
attractive force сила притяжения
attrition *n* истирание
auric acid золотая кислота
authorized pressure предельное давление
autoclave *n* автоклав
automation *n* автоматизация
automatic *a* автоматический
aurum *n* золото
author *n* автор
availability *n* наличие
available *a* доступный
average *a* средний
avoid *v* избегать
aware *a* знающий, сознающий
azo dye азокраситель
axis *n* ось

B

back pressure обратное давление
back reaction об ратная реакция
back run обратный процесс
back titration обратное титрование
backbone *n* основа, каркас
backflow *n* обратное течение
background *n* фон; задний план
backward *a* направленный назад; отсталый
backward flow противоток
bacteriological *a* бактериологический
bacterium *n* бактерия
bag *n* мешок; *u* упаковывать в мешок
bake *v* сушить; прокаливать; обжигать; спекать
balance *n* равновесие; баланс; весы; *v* взвешивать
balance beam коромысло весов
ball-bearing *n* шарикоподшипник
ball mill шаровая мельница
balm *n* бальзам
balloon *n* баллон
band *n* полоса; лента; слой
band spectrum полосатый спектр
bar *n* полоса; брусок
bare *a* голый; пустой; бедный (о породе)
barium *n* барий
barometer *n* барометр
barrel *n* барабан; баррель (мера объема)
base *n* основание
base metal неблагородный металл
base strength сила основания
basic *a* основной
basic capacity основность
basic ion катион
basicity *n* основность

basis *n* основание, основа
basket *n* корзина
basket grate корзиночная решетка
batch *n* дозировка; порция; загрузка; шихта
hatch fractionating периодическая ректификация
batch mixer мешалка периодического действия
batch process периодический процесс
bath *n* ванна; баня
battery acid аккумуляторная кислота
bay oil жирное лавровое масло
bay-tree oil лавровое масло
bead *n* бусина; шарик
bead catalyst зерненый катализатор
beaded glass гранулированное стекло
beaker *n* мензурка; химический стакан
beam *n* луч; пучок; *v* излучать
bear *v* нести нагрузку; подпирать; поддерживать
bearing *n* подшипник
because of *cj* из-за, вследствие
bed *n* фундамент; плита; слой; пласт
bedded *a* слоистый; напластованный
beer *n* пиво; бражка
beeswax *n* пчелиный воск
begin *v* начинать
beginning *n* начало
behave *v* вести себя; проявлять
behaviour *n* поведение
believe *v* считать, полагать; верить
below *prep* ниже
belt *n* ремень, лента
belt-drive *n* ременная передача
bend *v* изгибать; *n* изгиб; сгиб
benzene *n* бензол
benzoic acid бензойная кислота
beryllium *n* бериллий
beside *prep* рядом
besides *prep* кроме, помимо
best *a* лучший
beta-particle *n* бета-частица
biaxial *a* двухосный
bibasic acid двухосновная кислота
bicarbonate *n* бикарбонат
bicyclic *a* двуядерный; из двух циклов
bile acid желчная кислота
binary *a* бинарный
bind *v* связывать
binder *n* связующее вещество
biochemical *a* биохимический
biochemistry *n* биохимия
biological *a* биологический
biscuit *n* брикет
bismuth *n* висмут
bisulphate *n* бисульфат
bitter *a* горький
bitumen *n* битум; асфальт
bituminic oil битумная нефть
bivalent *a* двухвалентный
blade *n* лопасть, лезвие
blanch *v* белить
blank test холостой, слепой опыт
blast *n* взрыв; дутье; *v* взрывать; дуть
blast furnace доменная печь
bleach *v* отбеливать
bleaching agent отбеливающий агент
blend *n* смесь; *v* смешивать
blender *n* смеситель
block *n* преграда; узел; блок; *v* блокировать
blood *n* кровь

blow *v* дуть; *n* дутье; удар
blower *n* воздуходувка; стеклодув
blow lamp паяльная лампа
blue *a* голубой
blueprint *n* синька; светокопия
blue vitriol медный купорос
body *n* тело; основа
boil *v* кипеть; варить
boil dry выпаривать досуха
boiler *n* паровой котел; кипятильник
boiling *n* кипение
boiling point точка кипения
bomb *n* бомба; сосуд
bombard *v* бомбардировать
bombardment *n* бомбардировка
bond *n* связь; *v* связывать
bonding *n* связь; соединение
bonding material вяжущее вещество
bone *n* кость; *a* костяной
booster *n* вспомогательное средство
borax *n* бура
border *n* граница
border curve пограничная кривая
boric acid борная кислота
boring *n* расточка
boron *n* бор
both *a* оба
bottle *n* бутыль; склянка; баллон
bottom *n* дно; осадок; грунт
bound energy связанная энергия
bound water связанная вода
boundary *n* граница
boundary limit предел границы
boundless *a* безграничный
box *n* коробка; ящик; муфта
bracket *n* скобка; кронштейн
brake *n* тормоз
branch *n* область; ответвление
branched chain разветвленная цепь
branched reaction разветвленная реакция
branching *n* разветвление
brass *n* латунь
break *n* разлом; пролом; обрыв; разрыв; *v* ломать, разрушать
break down *n* поломка
break up *n* распад
breaker *n* дробилка
brick *n* кирпич
bridge *n* мостик, мостиковая связь
bridge bond мостиковая связь
brief *a* короткий
briefness *n* краткость
bright *a* светлый; яркий
brighten *v* очищать; полировать
brightening *n* осветление
brightness *n* блеск; яркость; прозрачность
brine *n* рассол
bring about *v* вызывать
bring forward *v* выдвигать
bring in *v* вносить
brittle *a* хрупкий; ломкий
broad *a* широкий
broaden *v* расширять
bromide *n* бромид
bromination *n* бромирование
bromine *n* бром
bronze *n* бронза
brown *a* коричневый
brown coal бурый уголь
brownian movement броуновское движение
brush *n* щетка; кисть
brush up *v* полировать; чистить
bubble *n* пузырек; *v* кипеть; барботировать
bubbler *n* барботер

bubbling *n* кипение; барботирование
bucket *n* ведро, ковш
buffer *n* буфер; буферный раствор
build *v* строить
build up *v* составлять; собирать, монтировать
bulb *n* колба; пузырек
bulk *n* блок; масса; объем
bulk analysis валовой анализ
bulk density объемный вес
bulk material рыхлый материал
bulky *a* объемный, громоздкий
buna *n* буна (синтетический каучук)
bunch *n* пучок
bundle *n* пучок, сгусток
Bunsen burner горелка Бунзена
burette *n* бюретка
burn *v* гореть
burner *n* горелка
burning *n* горение
burst *n* взрыв; *v* взрываться
bursting pressure давление разрыва
but *adv* но, а, кроме
but for *adv* если бы не
button *n* кнопка
butyl *n* бутил
by *prep* при помощи, посредством
by-product *n* побочный продукт

C

cadmium *n* кадмий
cage *n* кожух; клетка
cake *n* кусок; спекшийся материал
caking *n* спекание; слеживание
calcinate *v* обжигать; кальцинировать
calcite *n* кальцит, известковый шпат
calcium *n* кальций
calcium metaphosphate метафосфат кальция
calculate *v* вычислять
calculation *n* вычисление
calender *n* календарь
calibrate *v* градуировать
calibration *n* калибровка; градуировка
call *n* **вызов;** *v* называть
call for *v* требовать
caloric unit единица тепла
calorie *n* калория
calorific *a* тепловой; термический
calorifier *n* калорифер
calorimeter *n* калориметр
calorimetric *a* калориметрический
camphor *n* камфора
can *n* банка, сосуд
canal *n* канал; желоб
candle *n* свеча
candle wax свечной парафин
cane *n* тростник
cane sugar тростниковый сахар
canvas *n* парусина
cap *n* крышка, колпак
cap *v* покрывать
capable *a* способный
capability *n* мощность; способность; емкость
capacity *n* мощность; емкость
capillary *n* капилляр; *a* капиллярный
capital *a* главный
capsule *n* чашка; капсула
capture *n* захват
carbide *n* карбид

carbohydrate *n* углевод
carbolic acid фенол
carbolic oil фенольное масло
carbonaceous *a* углистый, углеродистый
carbon *n* углерод
carbon dioxide двуокись углерода
carbon monoxide окись углерода; угарный газ
carbon tetrachloride четырех хлор истый углерод
carbonate *n* карбонат
carbonic *a* угольный; углеродный
carbonite *n* карбонит (взрывчатое вещество)
carbonize *v* обугливать; подвергать сухой перегонке
carboxyl *n* карбоксил
carburated water gas карбюрированный водяной газ
cardboard *n* картон
careful *a* осторожный, тщательный
carrier *n* носитель
carry *v* носить
carry on *v* вести
carry out *v* проводить
case *n* случай; ящик; кожух; корпус
casein *n* казеин
cast *n* форма для отливки; *v* отливать
cast-iron *n* чугун
casting *n* отливка, литье
castor oil касторовое масло
catalysis *n* катализ
catalyst *n* катализатор
catalytic *a* каталитический
catalyze *v* катализировать
catalyzer *n* катализатор
catch *v* улавливать; *n* захват, ловушка
catch up with догнать
catch fire воспламеняться
category *n* категория
cathode *n* катод
cathodic *a* катодный
cathodic protection катодная защита
cation *n* катион
cation exchange resin катионообменная смола
cationic *a* катионный
cause *n* дело; причина; *v* вызывать
caustic *a* каустический
caustic alkali едкая щелочь
cave *n* зольник; полость; впадина
cavity *n* трещина; пустота
cease *v* прекращать
ceasure *n* захват
cell *ft* клетка; ячейка; элемент
cellulose *n* целлюлоза
cement *n* цемент
centigrade *n* стоградусный
centigram *n* сантиграмм
central *a* центральный
centre *n* центр
centrifugal *a* центробежный
centrifuge *n* центрифуга
century *n* век
ceramic *a* керамический
ceramics *n* керамика
ceria *n* окись церия
certain *a* некоторый; определенный
certainly *adv* конечно, несомненно
ceruse *n* свинцовые белила
cesium *n* цезий
chad *n* гравий, щебенка
chain *n* цепь; *v* соединять
chalcolite *n* хальколит

chalk *n* мел
chalk-stone *n* известняк
challenge *n* запрос; сигнал
chamber *n* камера
chance *n* возможность
change *v* изменять; *n* изменение
change into *v* превращать
chapter *n* глава
char *v* обугливать
character *n* отличительный признак, характерная особенность
characteristic *a* характерный, типичный
charcoal *n* древесный уголь
charge *n* заряд; загрузка
charge *v* заряжать; загружать
charging density плотность заряда
chart *n* диаграмма, схема
cheap *a* дешевый
check *v* проверять, контролировать; *n* контроль, проверка
check analysis контрольный анализ
check list контрольный список
chelate *a* клешневидный
chemical *a* химический
chemical fibre химическое волокно
chemical glass химический стакан
chemical resistance устойчивость к химикатам
chemisorption *n* хемосорбция **c**
hemist *n* химик
chemistry *n* химия
chief *a* главный
chill *n* холод; *v* охлаждать, замораживать; тускнеть
china *n* фарфор
china-ware *n* фарфоровые изделия
chlorate *n* хлорат
chloration *n* хлорирование
chloric acid хлорноватая кислота
chloride *n* хлорид
chlorination *n* хлорирование
chlorine *n* хлор
chloro-butyric *a* хлормасляная
chloroform *n* хлороформ
chlorophyl(l) *n* хлорофилл
chloroplatinic acid платинохлористо-водородная кислота
chlorous *a* хлористый
choice *n* выбор
choose *v* выбирать
chromate *n* хромат
chromatography *n* хроматография
chrome *n* хром
chromic acid хромовая кислота
chromium *n* хром
circle *n* круг, окружность; *v* вращаться
circuit *n* цепь, схема, кругооборот
circulation *n* циркуляция
circumstance *n* обстоятельство
citric acid лимонная кислота
claim *v* утверждать
clamp *n* зажим; *v* скреплять, зажимать
clarification *n* осветление
clarify *v* осветлять
class *n* класс; разряд
classification *n* классификация
classify *v* классифицировать
clay *n* глина
clay slip шликер
clean *v* очищать; *a* чистый; очищенный
cleaner *n* очиститель
clean-up *n* очистка
cleaning *n* очистка; осветление
cleaning agent осветлитель

cleanness *n* чистота; верность; прочность
clear *v* осветлять; очищать; *a* чистый, прозрачный
clear-starch *v* крахмалить
clear up *v* выяснять
clearing *n* осветление
cleat *n* клин; рейка; клемма
cleavable *a* колкий, легко раскалывающийся
cleavage *n* расщепление
cleave *v* расщеплять
clench *v* сжимать
climax *n* высшая точка
cling *v* прилипать
clink *n* звон
clinker *n* спекшийся материал; клинкер; шлак
clinkstone *n* фенолит
clip *n* прижим; зажим; скрепка
close *v* закрывать
close *a* близкий, тесный
closeness *n* сомкнутость; близость
cloth *n* ткань
clothing *n* одежда
cloud *n* пятно; облако; *v* затемнять; мутнеть
cloudy *a* мутный
cluster *n* кластер
coagulate *n* сгусток, коагулят
coagulating *n* свертывание, коагуляция
coal *n* уголь, каменный уголь
coal-dust *n* каменноугольная пыль
coalescence *n* соединение, слипание
coal-field *n* каменноугольный бассейн
coal-gas *n* светильный газ
coal-mine *n* угольная копь, шахта
coarse *a* необработанный, сырой
coarse-grained *a* крупнозернистый
coat *v* покрывать
coating *n* покрытие
cobalt *n* кобальт
cock *n* кран, затвор
coefficient *n* коэффициент
cohere *v* сцепляться
coherence *n* сцепление, связь
coherent *a* сцепленный, связанный
cohesion *n* сцепление
coil *n* катушка, намотка
coiled tube змеевик
coincide *v* совмещать; совпадать
coincidence *n* совпадение; схождение
coke *n* кокс
coke-oven gas светильный газ
coking *n* коксование; спекание
coking coal коксующийся уголь
cold *n* холод; *a* холодный
cold-work *n* холодная обработка металла
collapse *n* разрушение; поломка; авария; *v* рушиться, обваливаться
collar *n* переходная муфта; втулка; сальник
collection *n* собирание, сбор; скопление
collector *n* коллектор; сборник
collide *v* сталкиваться, ударяться
collision *n* столкновение; соударение
collodion *n* коллодий
colloid *n* коллоид
colloidal *a* коллоидный
colorimeter *n* колориметр; цветометр
colour *n* цвет
colourant *n* пигмент; краситель
colouration *n* окрашивание
coloured *a* цветной; окрашенный

coloured glass цветное стекло
colour-fast *a* невыцветающий; прочный (о красках)
colourless *a* бесцветный
column *n* столб; колонка
combination *n* соединение; состав; сочетание
combine *v* сочетать
combustible *a* горючий; топливный
combustion *n* горение, сгорание; сожжение; воспламенение; окисление
come *v* приходить, идти
come across *v* встречаться
come back *v* возвращаться
come down *v* снижаться
come forth *v* выходить наружу, проявляться
come forward *v* выступать
come from *v* происходить
come out *v* оказываться
come into being возникать
comfortable *n* удобный
commentary *n* истолкование, объяснение
commercial *a* промышленный
comminute *v* измельчать
commodity *n* предмет потребления
common *a* простой**,** общий
common salt поваренная соль
compact *a* плотный; *v* уплотнять
compatibility *n* уплотняемость
comparative *a* сравнительный
compare *v* сравнивать
comparison *n* сравнение
compatibility *n* совместимость
compatible *a* совместимый
compensate *v* компенсировать
compensation *n* компенсация
compete *v* конкурировать
competitive reaction конкурирующая реакция
compile *v* составлять
complementary *a* дополнительный
complete *a* полный; *v* завершать
completeness *n* полнота
completion *n* завершение, окончание
complex *n* комплекс; *a* сложный
complexator *n* комплексователь
complexity *n* сложность
complication *n* сложность
component *n* составная часть, компонент
compose *v* составлять
composite *a* составной
composition *n* состав; составление
compound *n* соединение
comprehensive *a* всесторонний, подробный
compress *v* сжимать
compressed air сжатый воздух
compressibility *n* сжимаемость
compressible *a* сжимаемый
compression *n* сжатие
compressor *n* компрессор
comprise *v* включать
compulsory *a* обязательный (для всех)
computation *n* вычисление
compute *v* вычислять, считать
computer *n* компьютер, ЭВМ
conceivable *a* возможный
concentrate *v* сосредоточивать
concentration *n* концентрация
concept *n* концепция, понятие
concern *v* касаться
concerted *a* совместимый
concise *a* сжатый
conclude *v* заключать, делать вывод

conclusive *a* убедительный
conclusively *adv* окончательно
concord *n* согласие
concrete *a* конкретный
concrete *n* бетон
concrete lining бетонное покрытие
condensability *n* сжимаемость
condensable *a* конденсируемый
condensation *n* конденсация
condenser *n* конденсатор
condition *n* условие; состояние
conditional *a* условный
conduct *v* проводить
conductance *n* проводимость
conductivity *n* проводимость
conductor *n* проводник
confer *v* сообщать, придавать
configuration *n* конфигурация
confine *v* ограничивать
confirm *v* подтверждать
conformity*n* соответствие
confront *v* противостоять
confuse *v* путать
conjugate *v* спрягать
conjugated *a* сопряженный
conjugation *n* сопряжение связей; соединение
conjunction *n* сочетание, соединение
cone *n* конус
connect *v* соединять
connection *n* связь
consequence *n* следствие
consequent *a* последовательный
consequently *adv* следовательно
consecutive *a* последующий
conservation *n* сохранение
conserve *v* сохранять
consider *v* рассматривать, считать
considerable *a* значительный
consideration *n* рассмотрение; положение
consist of *v* состоять из
consist in *v* заключаться
consistency *n* консистенция
consistent *a* совместимый
constancy *n* постоянство
constant *n* константа; *a* постоянный
constituent *n* составная часть
constitute *v* составлять
constitution *n* строение
construction *n* строение
consume *v* потреблять, расходовать
consumer goods товары потребления
consumption *n* расход, потребление
contact *n* соприкосновение
contain *v* содержать
container *n* сосуд
contaminant *n* загрязнитель
contamination *n* загрязнение
contemporary *a* современный
content *n* содержание
continual *a* длительный, сплошной
continuation *n* продолжение
continue *v* продолжаться
continuous *a* непрерывный
contract *v* сжиматься
contractibility *n* сжимаемость
contraction *n* сжатие; усадка
contrary *a* противоположный
contrast *n* противоположность, контраст
contribute *v* способствовать
contribution *n* вклад
control *v* регулировать, управлять
convection *n* конвекция

conventional *a* обычный; стандартный; условный
conversion *n* превращение
convert *v* превращать
convey *v* переводить; передавать
cool *v* охлаждать
coolant *n* охладитель
cooperate *v* взаимодействовать
cooperation *n* взаимодействие
coordinate *n* координата
coplanar *a* копланарный
copolymer *n* сополимер
copolymerization *n* совместная полимеризация
copper *n* медь
copperas *n* купорос (железный)
copper dioxide двуокись меди
copper pyrites медный колчедан
cord *n* веревка
core *n* сердцевина
cork *n* пробка
corner *n* угол
cornish granite корнуэльский гранат
corpuscle *n* шарик; корпускул
correct *a* верный, правильный
correction *n* уточнение; поправка
correctness *n* правильность
correlation *n* соотношение; корреляция
correspond *v* соответствовать
correspondence *n* соответствие
corresponding *a* соответствующий
corrode *v* корродировать
corrosion *n* коррозия
corrosive *a* коррозионный
corrugate *v* сморщивать
corrupt air испорченный воздух
cotton *n* хлопок
cottonseed oil хлопковое масло
count *u* считать
counter *n* счётчик
counteract *v* противодействовать
coontercurrent *n* противоток
counterpolarization *n* контрполяризация
countless *a* бесчисленный
couple *n* пара; *v* соединять; сочетать
coupled *a* сопряжённый
coupling *n* спаривание; сцепление
course*n* курс; ход; направление
covalence *n* ковалентность
covalent *a* ковалентный
covalent bond ковалентная связь
cover *n* крышка, колпак; *v* покрывать, охватывать
crack *n* трещина
cracker *n* дробилка
cracking *n* крекинг
cramp *n* скобка, зажим
crash *v* разбивать
crater *n* воронка
create *v* создавать; творить
creation *n* создание
creep *n* ползучесть
crevice *n* трещина
criterion *n* критерий
critical *a* критический
cross *v* пересекать; *n* пересечение
cross bond поперечная связь
cross link поперечная связь; сшивка
crosswise *adv* поперёк; крестообразно
crowding*n* уплотнение
crucible *n* тигель
crude *a* сырой, необработанный
crude oil сырая нефть
crumble *v* крошиться
crush *v* дробить
crusher *n* дробилка
crust *n* кора, корка

cryochemistry *n* химия низких температур
cryogen *n* охлаждающая смесь
cryohydrate *n* криогидрат
cryohydric *a* криогидратный
cryoscopic *a* криоскопический
cryoscopy *n* криоскопия
cryptone *n* криптон
crystal *n* кристалл; хрусталь
crystal growth рост кристаллов
crystalline *a* кристаллический
crystallization *n* кристаллизация
crystallohydrate *n* кристаллогидрат
crystallography *n* кристаллография
crystal water кристаллизационная вода
cube *n* куб
cubic *a* кубический
cultivate *v* обрабатывать
cultivation *n* обработка
cumulation effect кумулятивный эффект
cuprite *n* куприй
cupro-nickel *n* мельхиор
cuprous *a* содержащий одновалентную медь
cuprous sulphate сульфат меди
cure *v* отверждать
curing *n* сушка; отверждение
curing agent отвердитель
curium *n* кюрий
current *n* течение; ток
curriculum *n* учебный план
curve *n* кривая линия
cut *n* разрез; *v* резать; уменьшать
cutting *n* резка; срезание
cutting tool режу инструмент
cyanate *n* цианат
cyanic acid циановая кислота
cyanide *n* цианид
cycle *n* цикл
cyclic *a* циклический
cylinder *n* цилиндр

D

damage *n* повреждение
damp *a* влажный, сырой
damper *n* увлажнитель
dampness *n* влажность
damp-proof *a* влагонепроницаемый
danger *n* опасность
dangerous oils огнеопасные нефтепродукты
dark *a* тёмный
dark blue темносиний
data *n* данные
date *n* дата
dative bond семиполярная связь
deactivation *n* дезактивация
deactivator *n* дезактиватор
dead space мёртвое пространство
deaerate *v* удалять воздух
deal with *v* касаться; рассматривать
decade *n* десятилетие
decarbonizatfon *n* обезуглероживание
decarbonize *v* обезуглероживать
decarboxylation *n* дикарбоксилирование
decay *n* разложение, распад; *v* распадаться
decide *v* решать
decimal *n* десятичная дробь
decimeter *n* дециметр
decision *n* решение
decisive *a* явный
decline *n* упадок
decolour *v* обесцвечивать

decolourant *n* отбеливатель, деколорант
decolouration *n* обесцвечивание; изменение окраски
decompose *v* разлагать
decomposition *n* разложение
decorate *v* украшать
decorative porcelain художественный фарфор
decrease *n* уменьшение
deduce *v* выводить
deduction *n* дедукция; вывод
deed *n* дело
deep *a* глубокий
defect *n* дефект, недостаток
deficiency *n* недостаток
deficit *n* дефицит
define *v* определять
definite *a* определенный
definition *n* определение
deflection *n* отклонение; изгиб
deform *v* деформировать
deformation *n* деформация
degasification *n* дегазификация
degassing *n* дегазация; вакуумирование
degeneracy *n* вырождение
degenerate *v* вырождаться
degeneration *n* вырождение
degradation *n* разложение
degrade *v* деградировать
degrease *v* обезжиривать
degree *n* размер, степень, градус
dehydrate *v* обезвоживать
dehydration *n* дегидратация; обезвоживание
delay *n* задержка
deliberate *a* рассчитанный; намеренный
deliver *v* доставлять
delivery *n* доставка, подача
demand *n* требование; потребность
demand *v* требовать
demolish *v* разрушать
demolition *n* разрушение
demount *v* демонтировать
demonstrate *v* показывать
demonstration *n* показ; доказательство
denaturant *n* денатуризующее средство
denaturation *n* денатурация
denote *v* обозначать
dense *a* плотный, густой
dense bed плотный слой
densification *n* уплотнение
density *n* плотность
deodorant *n* дезодорант
deoxidation *n* восстановление
depend *v* зависеть
dependence *n* зависимость
depict *v* изображать
depolarization *n* деполяризация
depolymerization *n* деполимеризация
deposit *n* осадок; отложение; слой
deposition *n* осаждение; отложение
depress *v* снижать, понижать
depression *n* снижение
derivative *a* производный
derive *v* производить (от, из)
desalting *n* обессоливание
descret *a* дискретный; прерывный
describe *v* описывать
description *n* описание
desert *n* пустыня
deserve *v* заслуживать
desiccate *v* сушить
desiccation *n* сушка
desiccator *n* эксикатор; сушилка
design *n* устройство; проект

design *v* проектировать; конструировать
designate *v* характеризовать, определять
designer *n* проектировщик, конструктор
desirable *a* желаемый, нужный
desire *v* желать; *n* желание
desorption *n* десорпция
destroy *v* разрушать
destruction *n* разрушение
detach *v* отрывать; разъединять
detachment *n* отряд; группа
detail *n* деталь, подробность
detect *v* обнаруживать
detection *n* улавливание, обнаружение
detector *n* улавливатель
detergent *n* моющее средство
deterioration *n* ухудшение
determine *v* определять
determination *n* определение
detonate *v* детонировать
detonating wave детонационная волна
detonation *n* взрыв
deuterium *n* дейтерий
devastation *n* опустошение, разрушение
develop *v* развивать; разрабатывать; проявлять (фото)
development *n* развитие; проявление
deviate *v* отклонять
deviation *n* отклонение
device *n* прибор; устройство
devitrification *n* расстеклование
devote *v* посвящать
dew point точка росы
diagram *n* диаграмма; схема; график
diameter *n* диаметр
diamine *n* диамин
diamond *n* алмаз
diatomic *a* двухатомный
die *n* матрица
dielectric *n* диэлектрик
dielectric constant диэлектрическая постоянная
diethyl *n* диэтил
differ *v* различать
difference *n* различие; расхождение
different *a* разный, другой
differential *n* дифференциал
differentiation *n* дифференцирование
difficult *a* трудный
difficulty *n* затруднение, трудность
diffraction *n* дифракция
diffuse *v* диффундировать, распространять
diffusibility *n* диффузионная способность
diffusion *n* диффузия; распространение
digest *v* вываривать, переваривать
digestion *n* вываривание, переваривание
diluent *n* разбавитель
dilute *v* разбавлять
dilution *n* разбавление
dim *a* тусклый
dimension *n* размер
dimensional *a* размерный
dlmensionless *a* безразмерный
dlmer *n* димер
dimeric *a* димерный
dimerization димеризация
dimethyl *n* диметил
diminish *v* уменьшать
dimness *n* тусклость, помутнение
dioxide *n* двуокись
dip *и* окунать; погружать

dipole *n* диполь
direct *a*. прямой
direct current постоянный ток
direct heating прямое нагревание
direction *n* направление
dlrectiveness *n* направленность
dirt *n* грязь
dirty *a* грязный
disagreement *n* несоответствие
disappear *v* исчезать
disassemble *v* разбирать, демонтировать
discard *v* отказываться
discharge *n* разряд; разгрузка; *v* разряжать
disclose *v* открывать; обнаруживать
discolour *v* изменять цвет
discontinuous *a* прерывный
discontinuity *n* прерывистость
discover *v* обнаруживать
discovery *n* открытие
discrepancy *n* несоответствие, расхождение
discrete *a* прерывный; дискретный
discuss *v* обсуждать
discussion *n* обсуждение
dish *n* чаша, блюдо
disinfection *n* дезинфекция
disintegrate *v* распадаться
disintegration *n* распад
dislocation *n* смещение; перемещение
dismantle *v* разбирать, демонтировать
disparity *n* неравенство; несоответствие
disperse *v* диспергировать; рассеивать
dispersion *n* дисперсия; рассеивание
dispersity *n* дисперсность
displace *v* вытеснять; замещать
displacement *n* вытеснение; перемещение
display *v* проявлять, показывать
dispose *v* располагать
disposition *n* расположение
disproportion *n* диспропорция
disproportionate *n* диспропорционирование
disrupt *v* разрывать
disruption *n* разрыв
dissemination *n* рассеивание
dissipate*v* рассеивать
dissipation *n* рассеивание, утечка
dissociate *v* распадаться; диссоциировать
dissociation *n* диссоциация
dissociation degree степень диссоциации
dissolution *n* растворение
dissolve *v* растворять
dissymmetry *n* асимметрия
distance *n* расстояние; интервал
distant *a* дальний
distil *v* дистиллировать; перегонять
distillate *v* перегонять
distillation *n* дистилляция, перегонка
distinct *a* отчетливый
distinction *n* различие
distinctive *a* характерный
distinguish *v* различать
distort *v* искажать; деформировать
distortion *n* искажение; деформация
distribute *v* распределять
distribution *n* распределение
disturb *v* нарушать
disturbance *n* нарушение
disulfide *n* дисульфид
divalent *a* двухвалентный

divergence *n* расхождение
diverse *a* разнообразный
diversity *n* разнообразие
divide *v* делить
divisibility *n* делимость
divisible *a* делимый
division *n* разделение; деление
docking *n* стыковка
doctrine *n* учение; теория
dome *n* купол; колпак
domestic *a* домашний; внутренний
dominate *v* доминировать, преобладать
donor *n* донор
dope *n* присадка; наркотик
doped oil масло с присадкой
dosage *n* дозировка
dose *n* доза
dosimeter *n* дозирующий прибор
dot *n* точка
dotted line пунктир
double *a* двойной; *v* удваивать
double bond двойная связь
double-charged *a* двухзарядный
double-sided *a* двусторонний
doublet *n* диполь; дуплет
doubt *n* сомнение
dough *n* тесто; паста
downflow *n* нисходящий поток
dozen *n* десяток, дюжина
drain *n* сток; отвод
drainage *n* спуск воды; слив
draw *v* тянуть, вытягивать; рисовать; чертить
drawer *n* ящик
drawing *n* рисунок
draw-off *v* отводить; откачивать; сливать
drier *n* сушилка
drill *v* сверлить, бурить
drive *v* приводить в движение
driver *n* водитель
driving force ведущая сила
drop *n* капля; падение; *v* капать; падать; уменьшать
droplet *n* капелька
drug *n* лекарственное средство
drum *n* барабан
dry *a* сухой; *v* сушить
dry cleaning химическая чистка
dual а двусторонний; двойственный
duct *n* канал; трубопровод
ductile *a* тягучий; ковкий
ductility *n* эластичность; ковкость
due *a* должный, обусловленный
due to *adv* благодаря, из-за
dull *a* тусклый
duplex *a* двойной
durability *n* прочность
durable *a* прочный
during *prep* в течение
dust *n* пыль
duster *n* пылеуловитель
dust-proof *a* пыленепроницаемый
duty *n* режим, мощность
dye *n* краситель; *v* красить
dyeing *n* крашение
dyeing solution красильный раствор
dynamic *a* динамический
dynamics *n* динамика
dyne *n* дина

E

each *a* каждый
early *a* своевременный
earth *n* земля
earth crust земная кора

earth mantle оболочка земли
earth metals земельные металлы
earth wax озокерит
earthquake *n* землетрясение
earthware *n* глиняные изделия; фаянс; керамика
easy *a* легкий
ebonite *n* эбонит
edge *n* край, ребро
effect *n* действие; влияние; *v* влиять; осуществлять
effective *a* действительный, эффективный
effectiveness *n* эффективность
efficiency *n* коэффициент полезного действия
efficient *a* эффективный
effluent *n* вытекающий поток
effluents *n* сточные воды
efflux *n* утечка; истечение
effort *n* усилие; попытка
eigenfunction *n* собственная функция
eigenvalue *n* собственное значение
einsteinium *n* эйнштейний
either *pron* любой, каждый
eject *v* испускать; выбрасывать
ejection *n* выбрасывание
elaborate *v* разрабатывать; обрабатывать
elaboration *n* разработка
elastic *a* упругий; эластичный; гибкий
elastic limit предел упругости
elastic modulus модуль упругости
elastic resilience упругая удельная деформация
elasticity *n* упругость, эластичность
elastomer *n* эластомер (упругий полимер)
elastometer *n* прибор для измерения эластичности
electric arc электрическая дуга
electric cell гальванический элемент
electrical circuit электрическая цепь
electricity *n* электричество
electroconductivityti *n* электропроводность
electrode *n* электрод
electrodeposition *n* осаждение на электроде
electrolysis *n* электролиз
electrolyte *n* электролит
electrolytic dissociation электролитическая диссоциация
electrolyze уэлектролизовать
electromagnetic *a* электромагнитный
electromagnetism *n* электромагнетизм
electrometer *n* электрометр
electromotive force электродвижущая сила
electron *n* электрон
electron accelerator ускоритель электронов
electron emission электронная эмиссия
electronegative *a* электроотрицательный
electronegativity *n* электроотрицательность
electronic *a* электронный
electrophilic *a* электрофильный
electrophoresis *n* электрофорез
electroplate *v* покрывать гальванически
electroplating гальванопластика; гальванопокрытие
electropositive *a* электроположительный

electrostatic *a* электростатический
electrostatic bond электровалентная связь
electrovalency *n* электровалентность
electrovalent bond электровалентная связь
element *n* элемент
elemental *a* элементарный; первоначальный
elemental oxygen атомарный кислород
elementary *a* начальный; простой; элементарный
elevate *v* поднимать, повышать
elevated *a* высокий
elevator *n* подъемник; элеватор
eliminate *v* исключать; отщеплять; удалять
elimination *n* исключение; удаление; отщепление
elongate *v* удлинять
elongation *n* удлинение
eluate *v* вымывать; извлекать
elution *n* вымывание; извлечение
emanate *v* выделять
emanation *n* излучение; выделение
embed *v* включать
embedding *n* включение
emerge *v* выходить; возникать
emergence *n* выход; отток
emergency *n* чрезвычайное положение; авария
emergency control аварийное устройство
emery *n* наждак
emission *n* излучение; выделение; эмиссия
emission band полоса испускания
emission spectrum спектр испускания
emissive *a* испускающий; эмитирующий
emissivity *n* излучательная способность
emit *v* излучать; испускать
emitter *n* эмиттер
empirical *a* эмпирический
employ *v* применять
empty *a* пустой
emulgator *n* эмульгатор
emulsifier *n* эмульгатор
emulsify *v* эмульгировать; превращать в эмульсию
emulsion я эмульсия
enable *v* давать возможность
enamel *n* эмаль; *v* эмалировать
enclose *v* включать; ограждать
encounter *v* встречать
end *v* заканчивать
end reaction конечная реакция
endless *a* бесконечный
endothermic *a* эндотермический
endurance *n* выносливость
endure *v* переносить; выдерживать
energetics *n* энергетика
energy *n* энергия
energy content содержание энергии
energy level энергетический уровень
energy unit единица энергии
engine *n* двигатель; машина; мотор
engineering *n* техника; машиностроение
enhance *v* повышать; усиливать
enhancement *n* усиление; обогащение
enlarge *v* увеличивать
enlargement *n* увеличение
enough *adv* достаточно
enormous *a* огромный

enrichment *n* обогащение
ensurance *n* гарантия
ensure *v* обеспечивать; гарантировать
enter *v* вступать; входить
entirely *adv* всецело; совсем
entrance *n* вход
entropy *n* энтропия
envelope *n* оболочка; кожух
environment *n* среда; окружение
environmental protection охрана окружающей среды
enzyme *n* фермент
epimer *n* эпимер
epoxidation *n* эпоксидирование
epoxide *n* эпоксид
equal *a* равный
equality *n* равенство
equalizing *n* равенство; выравнивание
equation *n* уравнение
equilibrate *v* приводить в равновесие
equilibrium *n* равновесие
equip *v* оборудовать; оснащать
equipment *n* аппаратура; оборудование
equivalence *n* эквивалентность; равноценность
equivalent *n* эквивалент
erase *v* соскабливать; счищать
erbium *n* эрбий
erode *v* эродировать; разъедать
erosion *n* эрозия; разъедание
error *n* ошибка
escape *n* улетучивание; утечка
especially *adv* особенно
essence *n* сущность; эссенция; эфирное масло
essential *a* важный, существенный
establish *v* устанавливать
ester *n* сложный эфир
esterification *n* этерификация
estimate *v* оценивать
estimation *n* оценка
etch *v* травить
etching *n* травление
ethane *n* этан
ethanol *n* этиловый спирт
ether *n* простой эфир
etherification *n* этерификация; образование простого эфира
ethyl *n* этил
ethyl alcohol этиловый спирт
ethylene *n* этилен
europium *n* европий
eutectic *n* эвтектика
evacuate *v* откачивать; разряжать (воздух)
evacuated space разрежённое пространство
evaluate *v* оценивать
evaluation *n* оценка
evaporate *v* испарять; выпаривать
evaporating *n* выпаривание; испарение
evaporating column контрационная колонна
evaporating dish *n* выпарная чаша
evaporation *n* испарение; выпаривание
evaporator *n* испаритель
even *a* ровный; чётный; *adv* даже
evidence *n* доказательство
evolve *v* выделять; развивать
exact *a* точный
examination *n* исследование
examine *v* рассматривать; изучать
example *n* пример; образец
exceed *v* превышать
except *adv* кроме, помимо
exchange *n* обмен

exchanger *n* обменник
excitation *n* возбуждение
excite *v* возбуждать
excited *a* возбуждённый
excited energy level возбуждённый энергетический уровень
excited state возбуждённое состояние
exclude *v* исключать
exclusion *n* исключение
exert *v* оказывать воздействие
exhaust *n* выхлоп
exhibit *v* проявлять
exhibition *n* выставка
exist *v* существовать
exit gas отработанный газ
exothermal *a* экзотермический
exothermic *a* экзотермический
expand *v* расширять
expansion *n* расширение
expansion ratio степень расширения
expect *v* ожидать, предполагать
expel *v* вытеснять
expenditure *n* затрата, расход
experience *n* опыт
experiment *n* эксперимент
explode *v* взрывать
explain *v* объяснять
exploration *n* исследование
explosion *n* взрыв
explosive *n* взрывчатое вещество
explosive mixture взрывчатая смесь
exponent *n* показатель степени; экспонент
exponential экспоненциальный
expose *v* подвергать воздействию
exposition *n* экспозиция
exposure *n* экспозиция; выдержка; выставление
express *v* выражать
expression *n* выражение
expulsion *n* выбрасывание
extend *v* растягивать; увеличивать
extent *n* степень; величина
external *a* внешний; наружный
extinct *a* погашенный
extinction *n* погашение
extra *a* дополнительный; избыточный
extract *v* извлекать; экстрагировать
extraction *n* извлечение
extractive *a* извлекаемый
extrapolate *v* экстраполировать
extrapolation *n* экстраполяция
extreme *a* крайний; экстремальный
extrude *v* выдавливать; прессовать
extrusion *n* экструзия; выдавливание

F

fabric *n* ткань; структура
fabricate *v* изготовлять; производить
fabrication *n* производство; изготовление
face *n* поверхность; облицовка
facet *n* грань
facilitate *v* облегчать
facility *n* средство; устройство; помещение
facing *n* обработка; облицовка
factor *n* коэффициент; множитель
factory *n* фабрика, завод
fade *v* выцветать; блекнуть; исчезать

fading *n* выцветание; исчезновение
Fahrenheit scale шкала Фаренгейта
fall *v* быть неспособным; терпеть неудачу
fail-safe *a* надёжный; безопасный
failure *n* неудача
faint *a* слабый
fall *v* падать; снижать
fall *n* падение; снижение
falldown *n* невыполнение, срыв
fall-out *n* выпадение радиоактивных осадков
falling *n* падение, понижение
false *a* ложный
family *n* ряд; семейство
famous *a* знаменитый, известный
fan *n* вентилятор
fanner *n* вентилятор
fanning *n* вентилирование; обдувание
fast *a* прочный; закреплённый; быстрый
fasten *v* крепить
far *adv* далеко; значительно
fat *n* жир
fat-free *a* обезжиренный
fatigue *n* усталость
fatty *a* жирный
faucet *n* кран; вентиль
fault *n* дефект, повреждение
favourable *a* благоприятный
feasible *a* выполнимый, осуществимый
feather *n* выступ; гребень; шип
feature *n* черта, особенность
feed *v* подавать; питать; *n* подача; питание
feedback *n* обратная связь
feeding *n* подача; питание
feldspar *n* полевой шпат
felt *n* войлок; фетр
fence *n* ограда; предохранительный кожух
ferment *n* фермент; энзим
fermentation *n* ферментация; брожение
ferric *a* содержащий 3-валентное железо
ferric acid железная кислота
ferro-alloy *n* ферросплав
ferrous *a* содержащее 2-валентное железо
ferrous acid *n* железистая кислота
ferrum *n* железо
fertile *a* плодородный, плодоносящий
fertilizer *n* удобрение
few *a* мало
fibre *n* волокно; клетчатка
fibre glass стекловолокно
fibrous *a* волокнистый
field *n* поле; область
field test *n* полевое испытание
figure *n* фигура; цифра; рисунок
filament *n* нить лампы накаливания, волосок
file *n* нить, нитка; ряд; колонна
fill *v* наполнять
filler *n* наполнитель, заполняющий материал
filling *n* наполнение; набивка
film *n* плёнка
film-forming *a* плёнкообразующий
filter *v* фильтровать; *n* фильтр
filter paper фильтровальная бумага
filtering *n* процеживание, фильтрование
filtrate *n* фильтрат
filtration *n* фильтрование
fin *n* ребро; шов
final *a* конечный

find *v* находить
finding *n* обнаружение; поиск; данные
fine *a* тонкий, мелкий
fine powder тонкоизмельченный порошок
fine screening тонкий рассев
fine structure тонкая структура
finger *n* палец
finish *v* полировать; покрывать; *n* отделка; покрытие
finishing *n* окончательная отделка; обработка
finite *a* конечный; ограниченный
fire *v* топить; обжигать; *n* огонь
fire brick огнеупорный кирпич
fire extinguisher *n* огнетушитель
fireproof *a* огнестойкий
fire-resistant *a* огнеупорный
firing *n* разжигание; нагрев; отопление; воспламенение
fissile *a* делящийся; расщепляющийся
fissility *n* делимость
fission *n* расщепление
fissionable *a* делящийся; расщепляющийся
fit *v* подгонять
fitting *n* пригонка; монтаж; фитинг
fix *v* устанавливать; укреплять; зажимать
fixation *n* сгущение; затвердение
fixed *a* неподвижный; заданный; связанный
fixing *n* прикрепление; закрепление
flag *v* мостить плитами; *n* флаг; плита
flake *v* расслаивать; *n* чешуйка
flaky *a* чешуйчатый
flame *v* вспыхнуть; пылать; *n* пламя
flameless *a* беспламенный
flame-proof *a* огнестойкий
flammability *n* воспламеняемость
flammable *a* огнеопасный; воспламеняющийся
flange *n* гребень; фланец
flare *v* гореть ярким пламенем; *n* факел
flash *v* вспыхивать; *n* вспышка
flash-back *n* обратное зажигание
flash column испарительная колонна
flashing *n* блеск; сверкание; дуговой разрез
flashing point температура вспышки
flask *n* колба
flat *a* плоский
flat-bed *n* плоский слой
flatness *n* плоская поверхность
flatten *v* раскатывать в лист
flattening *n* расплющивание
flaw *v* давать трещину; *n* трещина; дефект
flax *n* лен
flexibility *n* гибкость
flexible *a* гибкий, эластичный
flexing *n* изгиб, изгибание
flight *n* направляющая насадка; пролет (частицы)
flint *n* кремень
float *v* плавать; флотировать; *n* поплавок
floatabiiity *n* плавучесть
floatation *n* плавание; флотация
floccular *a* хлопьевидный
flocculate *v* флоккулировать; выпадать хлопьями
flocculation *n* выпадение хлопьями
flocculator *n* хлопьеобразователь
flocks *n* хлопья

flood *v* наполнять
flooding *n* оводнение; захлебывание
floor *n* настил; грунт
flooring *n* настил; пол
flour *v* размалывать
flour *n* мука
flow *v* течь, растекаться; *n* поток, течение
fluctuate *v* изменяться; колебаться
fluctuation *n* колебание
flue gases топочные газы
fluent *n* поток, струя; *a* жидкий
fluid *a* жидкий
fluidity *n* текучесть
fluidize *v* разжижать
fluidized bed движущийся слой
fluorate *v* фторировать
fluoration *n* фторирование
fluorescence *n* флюоресценция
fluorescent *a* флюоресцентный
fluorhydric acid фтористоводородная кислота
fluoride *n* фторид
fluorination *n* фторирование
fluorine *n* фтор
fluoroscope *n* флюороскоп
flush *v* промывать; *n* струя воды
flushing *n* промывка, смывание
flux *n* поток, флюс
fluxibility *n* плавкость
fluxible *a* плавкий
fluxing *n* разжижение
fluxmeter *n* флюксметр
flux ratio отношение потоков
fly *n* маховое колесо; балансир; бегун
flyback *n* обратный ход
foam *v* пениться; *n* пена
foam rubber пористая резина
foamy *a* пенистый
fogging *n* образование тумана
foil *n* пленка; фольга
fold *v* сгибать; *n* складка; перегиб
follow *v* следовать за; придерживаться
food *n* пища, питание
foodstuff *n* корм, пища
foot *n* фут; нога; опора
force *v* заставлять; форсировать; *n* сила
forcing *n* форсирование, форсировка
foreign *a* инородный; примесный
forest *n* лес
forestry *n* лесоводство
fork *n* разветвление; стык; вилка
forked chain разветвленная цепь
form формировать; *n* форма
formaldehyde *n* формальдегид
formalin *n* формалин
formate *n* соль муравьиной кислоты
formation *n* образование, структура
formic acid муравьиная кислота
forming *n* формовка; формирование
formula *n* формула
fortification *n* фортификация; укрепление
forward *a* прямой
fossil *a* ископаемый, окаменелый
foul *a* грязный, загрязненный
foulness *n* загрязнение
found *v* основывать; формовать, отливать
foundation *n* основание, фундамент
foundry *n* плавильный завод; цех
fountain *n* фонтан
fraction *n* фракция; дробь
fractional *a* фракционный
fractionate *v* ректифицировать; фракционировать

fractionation *n* ректификация; фракционирование
fracture *n* излом; разлом
fragile *a* хрупкий, ломкий
fragility *n* хрупкость, ломкость
fragment *n* фрагмент; остаток; кусок
fragmentation *n* расщепление, разделение
frame *v* строить; составлять; *n* рама; каркас; остов
framework *n* каркас, конструкция, остов
francium *n* франций
free *v* освобождать; *a* свободный
freedom *n* люфт; зазор
freeing *n* удаление; освобождение
freeze *v* замерзать; замораживать
freezing point точка замерзания
freight *n* груз; фрахт
freon *n* фреон
frequency *n* частота
frequent *a* частый
fresh *a* свежий; новый; пресный
freshening *n* опреснение
freshwater *n* пресная вода
friction *n* трение
frictional force сила трения
frictionless *a* без трения, свободный от трения
fringe *n* край; кайма; бахрома
front *n* фасад, лицевая сторона
frontier *n* граница
frost *n* мороз; иней
frosting *n* образование матовой поверхности
frost-proof *a* морозостойкий
frozen *a* замёрзший, замороженный, застывший
fructose *n* плодовый сахар
fruit *n* плод, фрукт
fuel *n* топливо
fuelling *n* заправка топливом
fuel oil мазут
full *a* полный, обильный
fumaric acid фумаровая кислота
fume *v* дымиться; *n* дым
fume-proof *a* дымонепроницаемый
fuming acid дымящаяся кислота
function *v* действовать; *n* функция
fundamental *a* основной
fungicide *n* фунгицид
funnel *n* воронка
fur *n* мех, шкура
furan *n* фуран
furnace *n* печь
furnace clinker сварочный шлак
furnace coke металлургический кокс
furnace gas газ обжигательной печи
furnish *v* загружать, заполнять
furnishing *n* поставка, снабжение
further *a* дальнейший; дальний; *adv* далее
fuse *v* плавить
fusibility *n* плавкость
fusible *a* плавкий
fusion *n* плавление

G

gain *v* присоединять, получать, приобретать
galaxy *n* Галактика
gallium *n* галлий
gallon *n* галлон (4,546 л)
galvanic *a* гальванический
galvanic cell гальванический элемент

galvanization *n* гальваническое покрытие металлом; оцинковка
galvanometer *n* гальванометр
gamma-rays *n* гамма-лучи
gap *n* промежуток; люфт, зазор
garbage *n* отбросы
garnet *n* гранат
gas *n* газ
gas burner газовая горелка
gaseous *a* газообразный
gasify *v* газифицировать
gasket *n* прокладка
gas mask противогаз
gasoline *n* бензин; газолин
gas-proof *a* газонепроницаемый
gas well *n* газовая скважина
gauge *n* мера; калибр; измерительный прибор
gauge-glass водомерное стекло
gauze *n* сетка, марля
gear *n* шестерня; зубчатая передача
Geiger counter счетчик Гейгера
gel *n* гель
gelate *v* желатинировать
gelatin *n* желатин, животный клей
gelation *n* застывание; образование геля
gene *n* ген
general *a* общий
generalization *n* обобщение
generation *n* поколение; образование
generator *n* генератор
generator gas генераторный газ
genesis *n* генезис
genetics *n* генетика
genuine *a* подлинный
geochemical *a* геохимический
geometry *n* геометрия
germ *n* зародыш; бактерия
germanium *n* германий
giant *a* огромный
giant molecule макромолекула
give off *v* выделять
give out *v* испускать
give rise to *v* вызывать; приводить
give up *v* отдавать; отказываться
glacial *a* ледяной
glacial acetic acid ледяная уксусная кислота
glacier *n* ледник
glass *n* стекло; стакан
glass blower стеклодув
glass blowing выдувание стекла
glass fiber стекловолокно
glass forming substances стеклообразующие вещества
glass melt стекломасса, расплавленное стекло
glass wool стекловата
glassware *n* стеклянные изделия
glassy *a* стекловидный
glauber's salt глауберова соль
glaze *n* глазурь; глянец
glazing *n* глазурование
globule *n* шарик
gloss *n* глянец, блеск
gloss finish глянцевая отделка
glow *n* накал; свечение
glucose *n* глюкоза
glue *n* клей
glycerol *n* глицерин
glycol *n* гликоль
goal *n* цель
gold *n* золото
golden *a* золотой
gold-foil золотая фольга
gold number золотое число
goods *n* товары
govern *v* управлять, регулировать
governor *n* регулятор
grade *n* сорт; степень
gradient *n* градиент

gradual *a* постепенный
graduate *v* градуировать; окончить институт
graduated flask мерная колба
graduation *n* градуировка
graft *v* прививать
graft polymer графтполимер
grafting *n* прививка
grain*n* гранула; зерно
graining *n* гранулирование, кристаллообразование
grainy *a* зернистый
gram-molecule *n* грамм-молекула
granula *n* зернышко; гранула
granular *a* зернистый
grape-sugar *n* виноградный сахар
graphite *n* графит
grate *n* решётка
gravel *n* гравий
gravimetric *a* весовой; гравиметрический
gravitation *n* тяготение
gravitational *a* гравитационный
gravitational field гравитационное поле
gravity *n* сила тяжести; вес
gray slag свинцовый шлак
grease *n* жир
grease oil смазочное масло
greaseproof *a* жиронепроницаемый
greasy *a* сальный, жирный
grid *n* решётка; сетка
grind *v* измельчать, дробить
grinder *n* дробилка
grinding *n* измельчение
groove *n* канавка; нарезка
gross *a* валовой
ground *n* земля, грунт
ground state основное состояние
ground water почвенная вода
grow *v* расти;увеличивать (ся)
growth *n* рост
guard *n* охрана
guide *v* направлять; управлять
gum *n* смола; каучук; резина
gummed *a* прорезиненный
gun *n* пушка; пистолет
guncotton *n* нитроклетчатка
gunpowder *n* чёрный порох
gutter *n* желоб; слив
gypsum *n* гипс, сернокислый кальций

H

habit *n* особенность, свойство
haemoglobin *n* гемоглобин
hafnium *n* гафний
hail *n* град
hair *n* волосы
half *n* половина
half-life *n* период полураспада
half-time *n* период полураспада
halide *n* галоид
halogen *n* галоген
halogenation *n* галоидирование
halt *n* остановка
hammer *n* молот, молоток
hand *n* рука; стрелка
hand-made *a* ручной
handle *v* управлять; обращаться
handling *n* управление; манипулирование
handy *a* удобный (для пользования); легко управляемый
hang *v* вешать, подвешивать, навешивать
hard *a* твёрдый, жёсткий
harden *v* закаливать, отверждать
hardened *a* закалённый; отверждённый
hardening *n* закаливание; отверждение

hardness *n* твёрдость, жёсткость
hard water жёсткая вода
harmful *a* вредный
happen *v* случаться
hazard *n* опасность
hazardous *a* опасный
H-bomb *n* водородная бомба
head *n* голова; передняя часть; головка
header *n* водяной коллектор
heading *n* направление движения; заголовок
headway *n* продвижение; движение вперёд; поступательное движение
health *n* здоровье
heap *n* куча
heat *n* тепло; *v* нагревать
heat capacity теплоёмкость
heat conductivity теплопроводность
heat exchange теплообмен
heat exchanger теплообменник
heat-proof *a* теплостойкий
heat transfer теплопередача
heat unit единица тепла
heater *n* нагревательный прибор, калорифер
heating *n* отопление; нагревание
heavy *a* тяжёлый
heavy water тяжёлая вода
height *n* высота
helical *n* спираль
helicopter *n* вертолёт
helium *n* гелий
helix *n* спираль
hem *n* кайма; кромка; рубец
hemisphere *n* полушарие; полусфера
hence *adv* следовательно
hereditary *a* наследственный
herbicide *n* гербицид
heterocyclic *a* гетероциклический
heterogeneity *n* гетерогенность
heterogeneous *a* гетерогенный
heteronuclear *a* гетероциклический
heterosis *n* гетерозис
hexagonal *a* шестиугольный; гексогональный
hexahedral *a* шестигранный
hexahedron *n* гексаэдр
hexaoxide *n* шестиокись
high level высокий уровень
highly *adv* весьма, значительно
highmolecuiar *a* высокомолекулярный
high polymer высокий полимер
high-speed *a* скоростной
high-strength *a* высокопрочный
hinder *v* препятствовать
hindrance *n* помеха, препятствие
hold *v* держать
hold-up *n* задержка, остановка
holder *n* штатив, держатель
holding *n* выдерживание, хранение
hole *n* отверстие, дырка
holing *n* сверление; отверстие
hollow *a* полый, пустой
home-made *a* кустарный
homochromatic *a* равноцветный
homogeneity *n* однородность; гомогенность
homogeneous *a* гомогенный
homologous *a* гомологический; соответственный
homologue *n* гомолог
homology *n* гомология
homopolar *a* униполярный
homopolymer *n* гомополимер
honey *n* мёд
hood *n* вытяжной шкаф
horizon *n* горизонт
horizontal *a* горизонтальный
hormone *n* гормон

horse power лошадиная сила
hose *n* шланг
host *n* масса; множество
hot *a* горячий; опасный
hotbed *n* парник
hothouse *n* теплица
house *v* вмещать, хранить
household *a* бытовой
however *adv* однако
humic acid гуминовая кислота
humid *a* влажный
humidity *n* влажность
hurt *v* повреждать
hybrid *n* гибрид
hybridization *n* гибридизация
hydracid *n* водородная кислота
hydrant *n* гидрант
hydrate *n* гидрат
hydrated *a* гидратированный
hydration *n* гидратация
hydrazine *n* гидразин
hydride *n* гидрид
hydrocarbon *n* углеводород
hydrochloric acid соляная кислота
hydroiodic acid иодистоводородная кислота
hydrogen *n* водород
hydrogenation *n* гидрирование
hydrogen-sulphide *n* сероводород
hydrolysis *n* гидролиз
hydrolyze *v* гидролизовать
hydrophilic *a* гидрофильный
hydrophobic *a* гидрофобный
hydrophosphate *n* кислый фосфат
hydropolymerization *n* гидрополимеризация
hydrosulphate *n* гидросульфат
hydroxide *n* гидроокись
hydroscopic *a* гидроскопический
hyperfine *a* сверх тонкий
hyperoxide *n* перекись
hypersonic *a* сверхзвуковой
hysteresis *n* гистерезис
hy-therm *a* теплостойкий; жароупорный

I

ice *v* замораживать; *n* лёд
ideal *a* теоретический; идеальный
identical *a* тождественный, одинаковый
identification *n* установление; опознавание
Identify *v* устанавливать; определять
identity *n* тождественность, идентичность
idle *a* бездействующий; холостой
ignitabillty *n* воспламеняемость, возгораемость
ignite *v* зажигать, воспламенять
ignition *n* воспламенение, зажигание
ignorance *n* незнание, неведение
illinium *n* иллиний
illuminance *n* освещённость
illuminant *a* освещающий, осветительный
illuminate *v* освещать
illumination *n* освещение, распространение света
image *n* изображение
imaginable *a* мнимый
imaginary *a* мнимый, воображаемый
imitation *n* копирование, имитация
immature *a* незрелый; ранний
immediate *a* непосредственный; экстренный

immerse *v* погружать
immersion *n* погружение
immiscibility *n* несмешиваемость
immiscible *a* несмешиваемый
immobilize *v* делать неподвижным; связывать
immovable *a* неподвижный
immunity *n* иммунитет, невосприимчивость
impact *n* удар, импульс
impart *v* придавать; наделять; сообщать
impassability *n* непроходимость
impedance *n* полное сопротивление; импеданс
impel *v* приводить в движение; побуждать
impellent *n* движущая сила; двигатель
imperfection *n* неполнота; несовершенство; дефект; недостаток
impermeability *n* непроницаемость; герметичность
impermeable *a* непроницаемый; герметический
imply *v* подразумевать
imporosity *n* плотное строение
import *n* импорт
important *a* важный
impose *v* налагать
impregnate *v* пропитывать; насыщать
impregnation *n* пропитывание, пропитка; насыщение
imprint *n* отпечаток; штамп
improve *v* улучшать
improvement *n* улучшение; усовершенствование
improving *n* улучшение, повышение качества
impulse *n* удар, толчок, импульс
impure *a* неочищенный, засоренный
impurity *n* загрязнение
inaccessible *a* недоступный
inaccuracy *n* неточность, погрешность
inactive *a* инертный
inadequacy *n* несоответствие
inadequate *a* непропорциональный
inapplicability *n* неприменимость; непригодность
incandesce *v* накаливать; доводить до сведения
incandescent *a* светящийся от нагрева
inch *n* дюйм
incidence *n* падение; наклон; скос
incidental *a* случайный
inclination *n* наклонение; отклонение
include t; включать
inclusion *n* включение
incombustibility *n* негорючесть
incombustible *a* негорючий
incoming *a* входящий
incompatibility *n* несовместимость
incompatible *a* несовместимый, несовмещающийся
incomplete *a* неполный
incorporate *v* соединять; включать
increase *v* увеличивать
increase *n* увеличение
increment *n* возрастание, увеличение
independent *a* независимый
index *n* коэффициент; показатель
indicate *v* показывать
indication *n* указание; обозначение
indicator *n* индикатор; указатель; счётчик

indifferent *a* нейтральный; индифферентный
indigo *n* индиго; кубовый краситель
indirect *a* косвенный
indispensable *a* неотъемлемый
Indium *n* индий
indivisible *a* неделимый
induce *v* вызывать; побуждать
inductance *ti* индуктивность
induction *n* индукция
inductive *a* индукционный; индуктивный
inductor *n* индуктор
industrial *a* промышленный
industry *n* промышленность
inequality *n* неравенство
inert *a* инертный; нейтральный
inert gas инертный газ
inertia *n* инерция
infiltration *n* просачивание
infinite *a* бесконечный
inflame *v* воспламенять
inflammability *n* воспламеняемость
inflammable *a* горючий
inflammable fuel горючее топливо
inflexibility *n* несжимаемость
inflexible *a* жёсткий
inflexion *n* изгиб; изгибание
influence *v* влиять; *n* влияние
information *n* информация, данные
infra-red *a* инфракрасный
infusibility *n* тугоплавкость
infusible *a* тугоплавкий
ingot *n* слиток; болванка
ingredient *n* составная часть
inhibit *v* задерживать, тормозить
inhibitor *n* замедлитель, ингибитор
inhomogeneity *n* неоднородность
initial *a* начальный, исходный
initiate *v* начинать; инициировать
initiation *n* зарождение; инициирование
initiator *n* инициатор
inject *v* впрыскивать; вдувать
injection *n* впрыск; вдувание
injury *n* вред; повреждение
inlet *n* вход; впуск
inner *a* внутренний
innovation *n* нововведение
inorganic *a* неорганический
input *n* вход; подача; подвод
insensitive *a* нечувствительный
insert *v* вставлять
insert *n* включение; вставка
insertion *n* ввод; введение
inside *n* внутренняя сторона
insolubility *n* нерастворимость
insoluble *a* нерастворимый
instability *n* неустойчивость
install *v* располагать, размещать, устанавливать
installation *n* установка; устройство; оборудование
instant *n* момент, мгновение
instantaneous *a* мгновенный
instead of *ado* вместо
insulate *v* изолировать
insulator *n* изолятор
insusceptible *a* нечувствительный
intact *a* целый, нетронутый
intake *n* впуск; подвод
intensification *n* интенсификация
intensifier *n* усилитель
intensity *n* интенсивность
intensive *a* интенсивный
intention *n* намерение
interact *v* взаимодействовать
interaction *n* взаимодействие
interatomic *a* междуатомный
interface *n* поверхность раздела

interfere *v* мешать, препятствовать
interior *a* внутренний
intermediate *a* промежуточный
intermolecular *a* межмолекулярный
internal *a* внутренний
interpenetrate *v* взаимно проникать
interval *n* промежуток; расстояние; интервал
intrinsic *a* внутренний; присущий
introduce *v* вводить
introduction *n* введение
invariability *n* неизменность
invariance *n* инвариантность
invariant *a* инвариантный
inverse *a* обратный
inversion *n* обращение; инверсия
investigate *v* исследовать
investigation *n* исследование
invisible *a* невидимый
involve *v* включать
inward *a* внутренний
iodate *n* йодат
iodic *a* йодосодержащий, йодный
iodide *n* йодид
iodine *n* йод
iodine value йодное число
iodite *n* йодит
ion *n* ион
ionic *a* ионный
ionization *n* ионизация
ionize *v* ионизировать
ionogen *n* ионоген
iridium *n* иридий
iron *n* железо
irradiation *n* излучение, облучение
irregular *a* несимметричный, неровный
irreversibility *n* необратимость
irreversable reaction необратимая реакция
isobar *n* изобара
isolate *v* выделять
isolation *n* выделение
isomer *n* изомер
isomerism *n* изомерия
isomerization *n* изомеризация
isomorphic *a* изоморфный
isomorphous *a* изоморфный
isoprene *n* изопрен
isos tructural *a* изоструктурный
isotherm *n* изотерма
isotope *n* изотоп
isotropic axis ось изотропии
isotropy *n* изотропия
item *n* пункт; изделие
ivory *n* слоновая кость

J

jacket *n* кожух; рубашка
jar *n* банка
jelly *n* желе
jet *n* струя; сопло
jet-engine *n* реактивный двигатель
jet-pump *n* струйный насос
jetstone *n* чёрный турмалин
jetting *n* гидромеханизация
job *n* обрабатываемое изделие; работа
join *v* соединять
joint *n* соединение
jointiess *a* бесшовный
joule *n* джоуль
journal *n* журнал
jump *n* скачок; разрыв (функции)
junction *n* стык; узел
junior *a* младший

junior research worker младший научный сотрудник
just *adv* как раз, только что
justification *n* обоснование

K

kaolin *n* каолин
keep *v* держать, хранить
kernel *n* сердцевина
kerosene *n* керосин
ketone *n* кетон
kettle *n* котел
key *a* основной, главный
kiln *n* печь; сушилка
kilocalory *n* килокалория
kilogram *n* килограмм
kind *n* вид, тип
kindle *v* зажигать
kindling *n* воспламенение
kinescope *n* кинескоп
kinetic *a* кинетический
kinetics *n* кинетика
knead *v* перемешивать, замешивать
kneading *n* перемешивание, смешивание
knee *n* колено; кронштейн
knock *v* ударять; *n* удар, толчок
knock-free *a* недетонирующий
knot *n* узел
know-how *n* технология; знание дела
knowledge *n* знание
krypton *n* криптон

L

labelled atom меченый атом
labelling *n* введение меченых атомов; маркирование
lability *n* неустойчивость
laboratory *n* лаборатория
labour *n* труд
labour protection охрана труда
lace *n* шнурок, тесьма
lack *n* нехватка, недостаток
lacmus *n* лакмус
lacquer *n* лак
lacquer coat лаковое покрытие
lactose *n* лактоза, молочный сахар
lag *v* отставать; запаздывать
lagging *n* отставание
lame *a* испорченный, повреждённый
laminar *a* пластинчатый
laminate *v* расщеплять на тонкие слои
lamination *n* расслоение
land *n* земля, суша
lanolin *n* ланолин
lanthanoid *n* лантаноид
lanthanum *n* лантан
lap *n* перекрытие
last *v* длиться, продолжаться; *a* последний
lately *adv* недавно, за последнее время
latent heat скрытая теплота
latex *n* латекс
latitude *n* широта
lattice *n* кристаллическая решётка
launch *v* запускать, начинать, пускать в ход
law *n* закон
lay *v* положить
lay down *v* откладывать
layer *n* слой
leach *n* щелок; *v* выщелачивать
leaching *n* выщелачивание
lead *n* свинец
leaf *n* лист; фольга

leak *v* просачиваться; *n* утечка
leakage *n* утечка
lean coal тощий уголь
lean gas тощий газ
least *a* наименьший
leather *n* кожа
leave *v* оставлять
length *n* длина
lens *n* линза
let *v* пускать; отпускать; освобождать
level *n* уровень
levelling *n* выравнивание
lever *n* рычаг
liberate *v* освобождать, выделять
liberation *n* освобождение, выделение
lid *n* крышка
life *n* срок службы; долговечность
lie *v* лежать; находиться
lift *n* подъём; подъёмник
light *n* свет; *a* лёгкий, светлый
light metal лёгкий металл
light resistance светостойкость
lightfast dye светопрочная краска
lighting gas светильный газ
lignin(e) *n* лигнин
lignite *n* бурый уголь
likewise *adv* подобно, аналогично
lime *n* известь
limestone *n* известняк
liming *n* гашение извести
limit *v* ограничивать
limitation *n* ограничение, предел
limpid *a* прозрачный, просвечивающийся
limpidity *n* прозрачность
line *n* линия
linear *a* линейный
lining *n* облицовка
link *n* связь; звено
linkage *n* связь; сцепление
liquid *n* жидкость; *a* жидкий
liquid oil жидкое топливо
liquefy *v* сжижать
liquor *n* жидкость; раствор
list *n* список
lithium *n* литий
litmus *n* лакмус
litre *n* литр
load *n* груз; нагрузка; *v* нагружать
loading *n* наполнение, загрузка
localization *n* локализация
locate *v* располагать; находиться
logarithm *n* логарифм
long *a* длинный
loop *n* петля
loose *a* рыхлый; валентный
loosely *adv* свободно
loosen *v* ослаблять; отпускать
loss *n* потеря
low *a* низкий
low-alloyed *a* низколигированный
low-ash *a* малозольный
low-grade *a* низкосортный
lower *v* понижать
lowering *n* спуск; понижение
lubricant *n* смазочный материал
lubricants *n* смазочные масла
lubrication *n* смазка
luminescence *n* люминисценция
luminosity *n* яркость
luminous *a* светлый; ясный
lump *n* кусок
luster *n* блеск
lustrous *a* блестящий

M

machine *n* двигатель, мотор
machinery *n* машинное оборудование
machining *n* механическая обработка
macrocrystalline *a* крупнокристаллический
macroetching *n* макротравление
macromolecular *a* макромолекулярный
macromolecule *n* макромолекула
macroscopic *a* макроскопический
macros tru c ture *n* макроструктура
magazine *n* магазин (машины)
magnesite *n* магнезит
magnesium *n* магний
magnet *n* магнит
magnetic *a* магнитный
magnetism *n* магнетизм; магнитные свойства
magnetite *n* магнетит
magnetization *n* намагничивание
magnetize *v* намагничивать
magneto-conductivity *n* магнитопроводимость
magnetometer *n* магнитомер
magnet pole полюс магнита
magnification *n* увеличение
magnifier *n* увеличительное стекло, лупа
magnify *v* увеличивать
magnitude *n* величина, мощность
mahogany *n* красное дерево
mainspring *n* главная пружина
maintain *v* сохранять, поддерживать
maintainability *n* надёжность эксплуатации
maintenance *n* содержание; эксплуатация; уход; снабжение
maize *n* кукуруза, маис
major *a* главный, основной
majority *n* большинство
make up *n* структура, строение
making *n* изготовление; процесс; производство
malic acid яблочная кислота
malleability *n* ковкость; тягучесть
malleable *a* ковкий; тягучий
maltha *n* мальта (черная смолистая нефть)
manage *v* управлять, руководить
management *n* управление, руководство
manager *n* управляющий, заведующий
manganate *n* манганат
manganese *n* марганец
manifest *v* проявлять
manifestation *n* проявление
manifold *n* коллектор
manipulate *v* манипулировать; управлять
manipulation *n* обращение; управление
man-made *a* искусственный
manner *n* метод, способ
manoeuvrability *n* маневренность; подвижность
manograph *n* самопишущий манометр
manometer *n* манометр
mantle *n* кожух
manual *a* ручной
manufacture *n* производство; *v* производить
manufacturer *n* изготовитель
manufacturing *n* производство, изготовление; обработка
many-stage *a* многоступенчатый
map *n* карта, диаграмма
maple *n* клён

marble *n* мрамор
margarine *n* маргарин
margin *n* полоса; край; грань; предел; граница
marginal *a* боковой; краевой
marine *a* морской
mark *n* знак; отметка; маркировка; *v* отмечать
marking *n* маркировка; клеймовка
market *n* рынок
mash *n* пульпа
mash gas болотный газ, метан
mask *n* маска, противогаз
mass *n* масса
Mass Action Law закон действия масс
mass-spectrogram *n* масс-спектрограмма
mass-spectrograph *n* масс-спектрограф
mass-spectrography *n* масс-спектрография
mass-spectrometer *n* масс-спектрометр
mass unit единица массы
mast *n* мачта; опора
master *v* овладевать; усваивать
mat *n* мат; тюфяк; циновка
match *n* спичка; запал
matching *n* выравнивание; подгонка; соответствие
material *n* материал
mathematical *a* математический
matrix *n* матрица; форма
matter *n* материя; вещество; предмет; дело
mature *a* зрелый
maturing *n* созревание; стабилизация; старение
maximum *n* максимум
maximum output максимальная мощность
meal *n* мука крупного помола
mealy *a* мучнистый
mean *a* средний
meaning *n* значение
means *n* средство
measurability *n* измеримость
measurable *a* измеримый
measure *v* измерять
measurement *n* измерение
measuring *n* измерение; замер
measuring bottle мерная колба
measuring unit единица измерения
mechanical *a* механический
mechanics *n* механика
mechanism *n* механизм
mechanization *n* механизация
mechanize *v* механизировать
medical *a* медицинский
medicinal *n* медикамент
medicine *n* медицина; лекарство
medium *n* среда; *a* средний
meet *v* встречать; удовлетворять
megameter *n* мегаметр
megatron *n* мегатрон
melt *n* плавка; *v* плавить
meltability *n* плавкость
meltable *a* плавкий
melting *n* плавление; таяние
melting point точка плавления
member *n* деталь; звено
membrane *n* мембрана; диафрагма
memory *n* память
mend *v* ремонтировать
mending *n* починка, ремонт
mention *v* упоминать
mercaptane *n* меркаптан
mercury *n* ртуть
meridian *n* меридиан
merely *adv* просто, только
merit *n* качество, достоинство
mesh *n* отверстие сита; меш

mesh work *n* сетка; полотно сита
meson *n* мезон
mesonium *n* мезоний
mesosphere *n* мезосфера
mesotron *n* мезотрон
message *n* сообщение
metabolism *n* метаболизм; обмен веществ
metabolite *n* метаболит
metabolize *v* превращать в процессе обмена вещеетв
metal металл
metallic *a* металлический
metallization *n* металлизация
metallize *v* металлизировать; покрывать металлом
metalloid *n* неметалл, металлоид
metallurgical *a* металлургический
metallurgy *n* металлургия
metamorphism *n* метаморфизм
me testability *n* метастабильность
metastable *a* метастабильный; неустойчивый
meter *n* измерительный прибор; счетчик
metering *n* измерение
methane *n* метан
methanol *n* метанол
method *n* метод
methyl *n* метил
methylation *n* метилирование
methylene *n* метилен
mica *n* слюда
micelle *n* мицелла
microbalance *n* микровесы
microbiology *n* микробиология
microchemistry *n* микрохимия
microgramme *n* микрограмм
micrograph *n* микроснимок
micrometer *n* микрометр
micron *n* микрон
microorganism *n* микроорганизм
microscope *n* микроскоп
microscopy *n* микроскопия
micros tructure *n* микроструктура
middle *n* середина
migrate *v* перемещаться, мигрировать
migration *n* миграция, перемещение
mild *a* мягкий
mile *n* миля
milestone *n* веха
military *a* военный
milk *n* молоко; млечный сок
milky *a* молочный; млечный
mill *n* мельница, дробилка
milligramme *n* миллиграмм
millimetre *n* миллиметр
millstone *n* жернов
milscale *n* шкала в тысячных долях
mind *v* учитывать
mine *n* шахта
miner *n* шахтёр
mineral *n* минерал
mineralization *n* минерализация
mineral oil нефть; нефтепродукт
minimization *n* доведение до минимума
minimize *v* доводить до минимума
minimum *n* минимум
mining *n* горное дело
minus *n* минус
minute *a* мельчайший, крошечный
mirror *n* зеркало; рефлектор
mirror image зеркальное изображение
miscibility *n* смешиваемость
miscible *a* смешивающийся
miss *n* пропуск; перебой
miss *v* пропускать

missile *n* снаряд; ракета
mist *n* туман
mistake *n* ошибка, погрешность
mix *n* смесь; *v* смешивать
mixable *a* смешиваемый
mixer *n* смеситель, мешалка
mixed *a* смешанный
mixing *n* образование смеси, смешение
mixture *n* смесь
mobile *a* мобильный, подвижный
mobility *n* подвижность, маневренность
mode *n* способ; метод; форма; вид
model *n* модель, образец
modelling *n* моделирование
moderate *a* умеренный
moderation *n* умеренность; замедление
moderator *n* регулятор; замедлитель
modern *a* современный, новейший
modernization *n* модернизация
modernize *v* реконструировать, модернизировать
modification *n* модификация
modifier *n* модификатор
modify *v* видоизменять
modulate *v* модулировать; понижать частоту
modulation *n* модуляция
modulator *n* модулятор; активатор
module *n* модуль; коэффициент
modulus *n* модуль
modulus of elasticity модуль упругости (модуль Юнга)
moist *a* влажный
moisten *v* увлажнять, смачивать
moistening *n* увлажнение
moisture *n* влага
moisture free сухой
moisture-proof *a* влагонепроницаемый
moisture resistant гигроскопический
mol *n* моль
molal *a* мольный
molality *n* молярность
molar *a* молярный
molarity *n* молярность
mold *v* формовать
mole *n* моль; грамм-молекула
mole number мольное число
molecular *a* молекулярный
molecularity *n* молекулярность
molecule *n* молекула
molten *a* расплавленный; жидкий
molybdenum *n* молибден
moment *n* момент
momentum *n* количество движения
monitor *n* контрольно-измерительный прибор
monitoring *n* контроль, контролирование
monoacid *n* одноосновная кислота
monoatomic *a* одноатомный
monobasic *a* одноосновный
monocrystal *n* монокристалл
monolayer *a* однослойный
monomer *n* мономер
monomeric *a* мономерный
monophase *a* однофазный
monoxide *n* моноокись
moreover *ado* кроме того
moss *n* мох; торфяное болото
mother liquor маточный раствор
motion *n* движение
motor *n* двигатель, мотор
mould *n* форма для литья; *v* формовать
moulding *n* формовка

moulding press формовочный пресс
mount *n* крепление, опора
mountain *n* гора
mounting *n* монтаж
mouth *n* входное отверстие
movable *a* подвижный
move *v* двигаться
movement *n* движение
mud *n* грязь; тина
muddy *a* грязный; мутный
muff *n* муфта; втулка
muffle *n* муфель; муфельная печь
multiangular *a* многоугольный
multiatomic *a* многоатомный
multilayer *a* многослойный
multimeter *n* универсальный измерительный прибор
multiple *a* множественный; многократный
multiplication *n* умножение
multiplicity *n* сложность; разнообразие
multiply *v* умножать
multitude *n* множество
mutation *n* мутация
mutual *a* взаимный; общий
muzzle *n* сопло

N

narrow *a* узкий
narrow fraction узкая фракция
native *a* природный; местный; естественный
natrium *n* натрий
natural *a* естественный; природный; нормальный
natural rubber натуральный каучук
natural science естествознание
nature *n* природа; характер; сущность
naught *n* ноль
naval *a* военно-морской
nearly *adv* почти
necessary *a* необходимый
necessity *n* необходимость
neck *n* насадка; горло
need *v* требовать; нуждаться
needle *n* игла; стрелка
negative *a* отрицательный
negative charge отрицательный заряд
negligible *a* незначительный
neither ... nor *cj* ни... ни
neon *n* неон
neptunium *n* нептуний
net *n* нетто; чистый вес; сеть
net charge общий заряд
net efficiency общий коэффициент полезного действия
network *n* сеть; решётчатая система
neurological *a* неврологический
neutral *a* нейтральный; средний
neutrality *n* нейтральность
neutralization *n* нейтрализация
neutralize *v* нейтрализовать
neutron *n* нейтрон
neutron absorption поглощение нейтронов
neutron capture захват нейтронов
neutron population плотность нейтронов
nevertheless *adv* тем не менее
newton *n* ньютон (единица силы)
Newtonian mechanics ньютонова механика
nickel *n* никель
niobium *n* ниобий
nitrate *n* нитрат
nitration *n* нитрация; нитрование
nitre *n* селитра

nitric acid азотная кислота
nitric oxide окись азота
nitride *n* нитрид
nitrite *n* нитрит
nitrogen *n* азот
nitron *n* нитрон
nitrous acid азотистая кислота
noble *a* благородный; инертный
noble gas инертный газ
node *n* узел
nomenclature *n* номенклатура
non-aging *a* неподверженный старению
non-aqueous *a* неводный
non-ferrous *a* цветной (*о металле)*
non-inflammable *a* невоспламеняющийся
nonmetal *n* неметалл
normal *a* нормальный; стандартный
normalization *n* нормирование; нормализация
normalize *v* нормализовать; нормировать
nose *n* нос; выступ; сопло
notation *n* система обозначений
note *v* замечать
notice *v* замечать
noticeable *a* заметный
nourish *v* питать
novel *a* новый
nozzle *n* сопло
nuclear *a* ядерный
nuclear chain reaction цепная ядерная реакция
nuclear chemistry ядерная химия
nuclear physics ядерная физика
nuclear power ядерная энергия
nuclease *n* нуклеаза
nucleate *v* зарождаться; образовывать ядро
nucleation *n* образование зародышей
nuclei *n* ядра; центры кристаллизации
nucleic acid нуклеиновая кислота
nucleon *n* нуклон
nucleophilic *a* нуклеофильный
nucleus *n* ядро
nuclide *n* ядро; изотоп
null *n* нуль; *a* нулевой
null circuit нулевая схема
number *n* число; количество; номер
numerical *a* численный; числовой
numerous *a* многочисленный
nut *n* муфта
nutrient *a* питательный
nutrition *n* питание
nylon *n* нейлон

O

obey *v* подчиняться, удовлетворять
object *n* объект; предмет; цель
object *v* возражать
objective *n* цель; объектив
oblong *a* продолговатый; удлинённый
obscure *a* тёмный; тусклый
observable *a* заметный; видный
observance *n* соблюдение; исполнение
observation *n* наблюдение
observatory *n* обсерватория
observe *v* наблюдать
obsolete *a* устаревший
obstacle *n* препятствие; помеха
obstruct *v* преграждать; блокировать

obstruction *n* препятствие; закупорка
obtain *v* получать; добывать
obvious *a* очевидный, ясный
occasion *n* случай, повод, причина
occasional *a* случайный; временный
occupation *n* занятие; дело
occupy *v* занимать
occur *v* происходить; встречаться; залегать
occurrence *n* явление; местонахождение
octagon *n* восьмиугольник
octahedral *a* октаэдрический
octahedron *n* октаэдр
octane *n* октан
octane level октановое число
octavalent *a* восьмивалентный
octet *n* октет
octic acid каприловая кислота
odd *a* нечётный; лишний; случайный; свободный
odorant *n* отдушка; одорант
odorous *a* пахучий
odour *n* запах
odourless *a* без запаха
off-gas *n* отходы газа
office *n* управление, канцелярия
offset *n* возмещение
offtake *n* отъём, отвод
off-the-shelf *a* готовый
oil *n* нефть, масло
oil additives присадки к маслам
oil bath масляная баня
oil coke нефтяной кокс
oil-insoluble *a* маслостойкий
oil processing переработка нефти
oil refinery нефтеперерабатывающий завод
oil tar дёготь; гудрон
oil-tight *a* маслонепроницаемый
oily *a* маслянистый
ointment *n* мазь
olephin *n* олефин
oleum *n* олеум
omission *n* пропуск, упущение
omit *v* пропускать
once *adv* однажды, как только
once-through *a* однократный
only *cj* только
onset *n* начало
onward *adv* вперёд; далее
opacity *n* непрозрачность
opal *n* опал
opaque *a* непрозрачный
open *a* открытый
open cell разомкнутый элемент
opening *n* отверстие; зазор; открытие
opening of bond разрыв связи
operate *v* действовать; управлять
operation *n* действие; процесс; эксплуатация
operator *n* оператор; механик
oppose *v* противодействовать
opposing reaction обратная реакция
opposite *a* противоположный; обратный
opposition *n* сопротивление
optical *a* оптический
optics *n* оптика
optimal *a* оптимальный
optimum *a* оптимальный
orange oil апельсиновое масло
orbit *n* орбита
orbital *n* орбиталь
order *n* порядок, последовательность
ordered *a* упорядоченный
ordinal *a* порядковый
ordinary *a* обычный
ore *n* руда
organic *a* органический

organic chemistry органическая химия
organization *n* организация; устройство
organ ometal lie *a* металлоорганический
orient *v* ориентировать
orientation *n* ориентация
orifice *n* отверстие; сопло
origin *n* источник; начало
original *a* исходный; первоначальный
original mixture исходная смесь
originate *v* вести начало
orthogon *n* прямоугольник
oscillate *v* колебаться; вибрировать
oscillation *n* колебание; осцилляция
oscillator *n* осциллятор; вибратор
oscillogram *n* осциллограмма
osmium *n* осмий
osmosis *n* осмос
osmotic pressure осмотическое давление
other *a* другой
out *adv* вне, из; наружный
outburst *n* взрыв; вспышка
outcome *n* результат; исход
outer *a* внешний
outermost orbit внешняя орбита
outer shell внешняя оболочка
outer space открытый космос
outfit *n* оборудование; приборы
outing *n* выход; извержение
outlet *n* выпуск; выход; выпускное отверстие
outline *n* контур; эскиз
output *n* выход; производительность; мощность
outside *a* внешний
outstanding *a* выдающийся; заметный
outward *prep* направленный наружу
oven *n* печь
overall *a* полный; общий
overburden *v* перегружать
overcome *v* преодолевать
overcooling *n* переохлаждение
overdrying *n* пересушка
overflooding *n* захлёбывание
overflow *n* слив; перелив
overgrind *v* переизмельчать
overhead *a* верхний; наверху; наземный
overheating *n* перегрев
overlapping *n* положение; перекрытие
overrun *n* перерасход
overtime *n* сверхурочное время
own *a* собственный
owner *n* владелец; заказчик
ownership *n* право на собственность
oxalic acid щавелевая кислота
oxidability *n* окисляемость
oxidable *a* окисляемый
oxidant *n* окислитель
oxidate *v* окислять
oxidation *n* окисление
oxidation number степень окисления
oxidation-reduction *n* окисление-восстановление
oxidative *a* окислительный
oxide *n* окись; оксид
oxidize *v* окислять
oxidizing agent окислитель
oxygen *n* кислород
oxygen welding автогенная сварка
oxygenate *v* насыщать кислородом
oxyhydrogen *n* гремучий газ
ozone *n* озон

ozonization *n* озонирование

P

pace *n* шаг; длина шага; скорость, темп
pack *v* упаковывать; насаживать; *n* связка, пакет, кипа, тюк
package *n* тюк; кипа; пакет
packaged *a* компактный; в упакованном виде
packaging *n* упаковка; расфасовка
packed а упакованный; уплотнённый
packer *n* машина для упаковки, паккер, сальник
packing *n* насадка, прокладка
pad *n* подушка; прокладка; втулка; затычка
padding *n* набивка; набивочный материал
page *n* страница
paint *n* краска; красочное покрытие; *v* покрывать краской
painting *n* окрашивание, окраска
pair *n* пара
pairing *n* образование пары; спаривание
pale *a* палевый; бледный; слабый; тусклый
palladium *n* палладий
pallet *n* поддон; транспортный стеллаж
palm *n* пальма; ладонь, лапа (якоря)
palmitin *n* пальмитин (глицериновый эфир пальмитиновой кислоты)
palmitinic acid пальмитиновая кислота
pan *n* чан; чашка весов
panchromatic *a* панхроматический
pane *n* оконное стекло; грань (гайки)
panel *n* панель; стенка; щит
panelling *n* обшивка; облицовка плитами
panorama *n* панорама
paper *n* бумага; статья; *u* оклеивать бумагой
paperboard *n* картон
papier *n* папьемаше
papyrus *n* папирус; папирусная бумага
para-acid *n* паракислота
paraaminophenol *n* парааминофенол
parabola *n* парабола
paraffin *n* парафин
paraffinaceous *a* парафинистый
parahydrogen *n* параводород
parallel *n* параллельная линия; параллель
paralleling *n* параллельное включение
parallelism *n* параллельность; параллелизм
paramagnet *n* парамагнитное вещество
parameter *n* параметр
parcel *n* пакет; сверток
parent element материнский элемент; исходный элемент
parent isotope материнский изотоп
parent nucleus материнское ядро
parity *n* чётность; равенство; соответствие
parity selection rule право отбора по четности
part *n* часть; доля; *v* делить на доли

partial *a* частичный; парциальный
partial condensation частичная конденсация
partial conversion coefficient парциальный коэффициент конверсии
partial pressure парциальное давление
participate *v* участвовать
participation *n* участие
particle *n* частица
particle accelerator ускоритель частиц
particle flux поток частиц
particular *a* особый; частный
particularity *n* особенность; подробность
partition *n* перегородка
partition coefficient коэффициент распределения
pass *v* проходить; пропускать
passage *n* проход; прохождение
passage centre центр трубки
passivate *v* пассивировать
passivation *n* пассивация
passive *a* пассивный; инертный
passivity *n* пассивность
paste *n* паста; мастика; клей
pasteurize *v* пастеризовать
pasteurizing *n* пастеризация
patent *n* диплом; патент; *v* выдавать патент
path *n* пробег, путь
path length *n* длина пробега
pathway *n* путь; траектория
pattern *n* образец, модель
pause *n* пауза, перерыв
pay attention обращать внимание
peak *n* максимум; высшая точка
peculiar *a* особенный; своеобразный
pedestal *n* основание; пьедестал
peel *v* снимать покрытие
peel off *v* отслаивать(ся); сдирать(ся)
peeling *n* отслаивание
pellet *n* шарик
pencil *n* узкий пучок лучей
penetrable *a* проницаемый
penetrate *v* проникать
penetrating odour едкий запах
penetrating radiation проникающее излучение
penetration *n* проникновение
pentagon *n* пятиугольник
pentagonal *a* пятиугольный
pentavalent *a* пятивалентный
peptide *n* пептид
peptization *n* пептизация
per *prep* в, на
peracid *n* надкислота, перкислота
perceive *v* понимать, постигать
percent *n* процент
percentage *n* процентное содержание
perfect *a* совершенный, идеальный
perfect gas идеальный газ
perforate *v* пронизывать; перфорировать
perforated *a* перфорированный; пористый
perforation *n* просверливание; отверстие, дыра
perforator *n* перфоратор
performance *n* эксплуатация; работа
period *n* период
Periodic Law периодический закон Менделеева
periodic system of elements периодическая таблица элементов
periodic table периодическая таблица элементов Менделеева
periodical *a* периодический

periodicity *n* периодичность
peripheral *a* периферический; окружной
peripheral electron периферический электрон
periphery *n* периферия; окружность
permanency *n* перманентность; постоянство
permanent *a* постоянный
permanent deformation остаточная деформация
permanent expansion остаточное расширение
permanent gas постоянный газ
permanent precipitation неисчезающий осадок
permanganate *n* перманганат
permanganate bleaching отбелка перманганатом
permanganate oxidation окисление перманганатом
permeability *n* проницаемость
permeable *a* проницаемый
permeate *v* проникать
permeation *n* просачивание; проникновение
permissible *a* разрешённый, допустимый
permit *v* позволить, давать возможность
peroxide *n* перекись
perpetual *a* постоянный; беспрерывный; бесконечный
persist *v* сохраняться
persistence *n* постоянство, непрерывность
perturbation *n* возмущение; нарушение
perturbation theory теория возмущения
pervade *v* проникать, распространяться
pervasion *n* проникновение
petrol *n* нефть; керосин
petroleum *n* нефть; керосин
petroleum oil керосин
pharmaceutical *a* фармацевтический
pharmaceutics *n* фармацевтика
pharmacology *n* фармакология
phase *n* фаза
phase angle фазовый угол
phase shift сдвиг фаз
phase-to-phase *a* междуфазный
phenate *n* эфир фенола
phenil *n* фенил
phenol *n* фненол
phenol acid феноло-кислота
phenomena *n* явления
phenomenon *n* явление
phosphorescence *n* фосфоресценция
phosphorus *n* фосфор
photoactive *a* светочувствительный
photocell *n* фотоэлемент
photochemical *a* фотохимический
photochemistry *n* фотохимия
photochlorination *n* хлорирование на свету
photoconductivity *n* фотоэлектрическая проводимость
photoelasticity *n* фотоэластичность
photoelectron *n* фотоэлектрон
photolysis *n* фотолиз
photon *n* фотон
photooxydation *n* фотоокисление
photoreaction *n* фотохимическая реакция
photostability *n* светостойкость
photos table *a* светостойкий
photosynthesis *n* фотохимический синтез

phthalic acid фталевая кислота
physical *a* физический
physical analysis физический анализ
physical equation уравнение физического состояния
physical scale физическая шкала
physicist *n* физик
physics *n* физика
physics of cosmic radiation физика космического излучения
pick *v* выбирать
pick up *v* отбирать; принимать на себя
pickle *n* кислотная ванна; *v* травить кислотой
pickling *n* травление
pickling bath травильная ванна
picture *n* картина; представление; модель
pie *n* диск
piece *n* кусок; часть
pig *n* болванка, чушка
pig-iron *n* чугун
pigment *n* пигмент
pigmentary *a* пигментный
pigmentation *n* пигментация
pile *n* груда; реактор
pile assembly *n* ядерный реактор
pile behaviour *n* поведение реактора
pile envelope *n* оболочка реактора
pile face *n* лицевая сторона реактора
pile geometry *n* геометрия реактора
pile kinetics *n* кинетика реактора
pillow *n* подшипник, подкладка
pilot plant опытная установка
pin *n* шпилька, штифт
pint *n* пинта (0,568 л)
pipe *n* труба
pipeline *n* трубопровод
pipette *n* пипетка
piping *n* трубопровод
piston *n* поршень
pit *n* яма, выемка
pit-coal *n* каменный уголь
pit-kiln *n* коксовальная печь
pitch *n* смола, пек; шаг нарезки, угол наклона
pitchblend *n* урановая смола
pitting *n* точечная коррозия
place *n* место; *v* помещать
plain *a* ровный; гладкий; одноцветный; простой
plan *n* план; чертеж; схема; проект; *v* составлять план
planar *a* планарный
plan area площадь поперечного сечения
plane *n* плоскость
plane boundary плоская граница раздела
planetary electron орбитальный электрон
Plank's constant постоянная Планка
Plank's law закон Планка
planning *n* составление чертежа, плана; планирование
plant *n* растение; завод
plasma *n* плазма
plasma cell плазматическая клетка
plastic *a* пластичный
plasticate *n* пластикат; *v* пластицировать
plastication *n* пластикация
plasticator *n* пластикатор
plasticity *n* пластичность
plasticizing agent пластификатор
plastics *n* пластмасса
plastics processing переработка пластмасс

plastifier *n* пластификатор
plate *n* плита; пластинка; тарелка; *v* покрывать
plating *n* гальваническое покрытие; покрывание металлом
plating bath гальваническая ванна
platinum *n* платина
platinum oxide окись платины
pleasant *a* приятный
plenty *n* множество
plot *n* график; *v* наносить на график
plug *n* штепсель; пробка; *v* заглушать, глушить
plumbic acid свинцовая кислота
plumbic chloride хлористый свинец
plumbum *n* свинец
plutonium *n* плутоний
pneumatic *a* пневматический
point *n* точка
point out *v* указывать
poison *n* яд; *v* отравлять
poisonous *a* ядовитый
polar *a* полярный
polar axis полярная ось
polar bond полярная связь
polarimeter *n* поляриметр
polarimetry *n* поляриметрия
polarity *n* полярность
polarization *n* поляризация
polar link полярная связь
pole *n* полюс
pole effect полюсный эффект
pole terminal полюсный зажим
polish *v* полировать, шлифовать
polishing *n* полирование
pollute *v* загрязнять
pollution *n* загрязнение
polyamid *n* полиамид
polyatomic acid многоосновная кислота
polyester *n* полиэфир
polyether *n* полимер простого эфира
polyethylene *n* полиэтилен
polymer *n* полимер
polymer blend смесь полимеров
polymeric *a* полимерный
polimerization *n* полимеризация
polymerize *v* полимеризовать
polymorphous *a* полиморфный
polymorphy *n* полиморфизм
polyoxide *n* многоокись; полиокись
polysulphide *n* полисульфид
poly valency *n* многовалентность
pond *n* сливной ящик
poor *a* бедный; тощий
poor concrete тощий бетон
poor mixture тощий раствор
poor ore бедная руда
poppy *n* мак
poppy oil маковое масло
population *n* плотность атомов; популяция
porcelain *n* фарфор
porcelain clay каолин
porcelain crucible фарфоровый тигель
porcelain enamel фарфоровая эмаль
porcelain ware фарфоровые изделия
pore *n* пора
porosity *ti* пористость
porous *a* пористый
porousness *n* пористость
porphin *n* порфин
porphyrin *n* порфирин
port *n* отверстие; вход
portable *a* переносной
portion *n* порция, часть
portiand-cement *n* портланд-цемент

position *n* положение
positive *a* положительный
positive charge положительный заряд
positive electron позитрон
positive energy state состояние с положительной энергией
positron *n* позитрон
possess *и* обладать
possibility *n* возможность
possible *a* возможный
postulate *и* постулировать
postulation *n* констатация
pot *n* тигель
pot furnace тигельная печь
pot lead графит
potable water питьевая вода
potash *n* поташ
potassium *n* калий
potency *n* потенциал, сила
potential *a* потенциальный
potential difference разность потенциалов
potential energy потенциальная энергия
potentiometer *n* потенциометр
pottery *n* фаянс; гончарное изделие
pound *n* фунт
pour *v* лить; приливать
powder *n* порошок; *a* превращать в порошок
power *n* сила, мощность
power consumption потребление энергии
power plant энергетическая установка
power reactor энергетический реактор
power station электростанция
power transformer силовой трансформатор
practice *n* практика
precaution *n* предосторожность
precede *v* предшествовать
precious *a* драгоценный
precipitate *n* осадок
precipitate *v* осаждать
precipitation *n* осаждение
precipitation column осадительная колонна
precipitation heat теплота осаждения
precise *a* точный
precision *n* точность
predict *v* предсказывать
preliminary *a* предварительный
premature *a* преждевременный
preparation *n* получение; приготовление
prepare *v* приготавливать; получать
prescribe *v* предписывать
prescription *n* предписание
presence *n* наличие, присутствие
present *a* данный, настоящий
preservation *n* сохранение
preserve *v* сохранять; предохранять
press *v* прессовать
pressure *n* давление
pressure gauge манометр
pressure drop перепад давления
presume *v* предполагать
presumption *n* предположение
prevent *v* предотвращать, препятствовать
prevention *n* ограждение; предотвращение
preventive *a* предупредительный; предохранительный
previous *a* предыдущий; ранний
price *n* цена
primary *a* первичный, исходный
principal *a* главный, основной
print *n* отпечаток; оттиск; шрифт

prior *a* предшествующий
prism *n* призма
private *a* частный
probability *n* вероятность
probable *a* вероятный
probe *n* образец, зонд
problem *n* задача
procedure *n* методика, метод, процедура
proceed *v* протекать; следовать
process *n* процесс
processing *n* обработка; пригонка
processing industry перерабатывающая промышленность
produce *v* производить
producer *n* производитель
product *n* продукт
production *n* производство
progress *n* прогресс; успех
prohibit *v* препятствовать; запрещать
prohibition запрещение
project *n* проект, план
project *v* проектировать
projectile *n* метательный снаряд
prominent *a* отличительный, заметный
promote *v* промотировать; способствовать; ускорять
promoter *n* активатор, усилитель
proof *n* испытание; проба; доказательство
propagate *v* распространять
propagation *n* распространение
propane *n* пропан
propel *v* двигать; приводить в движение
propellent *n* реактивное топливо
proper *a* правильный; надлежащий; должный
property *n* свойство
proportion *n* пропорция
proportional *a* пропорциональный
propose *v* предлагать
propylene *n* пропилен
propyonic acid пропионовая кислота
prospect *n* вид; перспектива
protect *v* защищать; предохранять
protective coating защитное покрытие
protein *n* белок; протеин
proton *n* протон
prove *v* доказывать
provide *v* снабжать; обеспечивать
prussic acid синильная кислота
pseudo-acid *n* псевдокислота
publish *v* публиковать, печатать
publication *n* издание, опубликование
pull *v* растягивать; тянуть
pulp *n* пульпа; кашица
pulse *n* импульс; толчок
pulverize *v* пульверизировать, распылять; размельчать
pump *n* насос; помпа; *v* накачивать
pure *a* чистый
purge *v* очищать; продувать
purification *n* очистка
purified gas очищенный газ
purify *v* очищать
purity *n* чистота
purpose *n* цель
push *n* толчок; *v* толкать
put forward *v* выдвигать
putrefaction *v* гниение
putrefy *v* гнить, загнивать
pyridine *n* пиридин
pyrosulphate *n* пиросульфат
pyroxylin *n* пироксилин

Q

quadrant *n* квадрант
quadriatomic *a* четырёх атомный
quadribasic *a* четырёхосновный
quadrivalent *a* четырёхвалентный
quadrupole *n* квадруполь
quake *v* дрожать; колыхаться
qualitative *a* качественный
quality *n* качество
quantitative *a* количественный
quantity *n* количество; величина
quantum *n* квант
quantum number квантовое число
quantum mechanics квантовая механика
quartz *n* кварц
quartz bath кварцевая ванна
quaternary *a* четвертичный
quench *v* тушить; охлаждать; закаливать (металл)
quenching *n* закалка; гашение
question *n* вопрос
quicklime негашеная известь
quiet *a* тихий, бесшумный
quietness *n* тишина; покой
quinary *a* пятикомпонентный
quinine *n* хинин
quinoline *n* хинолин
quinone *n* хинон
quite *adv* весьма, очень
quote *v* указывать; цитировать

R

racemization *n* рецемизация
radar *n* радар
radial *a* радиальный
radiant *a* лучистый
radiate *v* излучать
radiation *n* излучение
radical *n* радикал
radii *n* радиусы
radioactive *a* радиоактивный
radioactive disintegration радиоактивный распад
radioactivity *n* радиоактивность
radiocarbon *n* радиоактивный изотоп углерода
radiochemistry *n* радиохимия
radio-element *n* радиоактивный элемент
radiogram *n* радиограмма
radiographic(al) *a* рентгенографический
radiography *n* рентгенография
radioisotope *n* радиоактивный изотоп
radio-labelled *a* меченый радиоактивным изотопом
radiolysis *n* радиолиз
radium *n* радий
radium bromide бромистый радий
radius *n* радиус
radon *n* радон
rain water дождевая вода
raise *v* увеличивать; поднимать
random *a* беспорядочный, хаотичный
randomness *n* беспорядочность, хаотичность
range *n* ряд, предел
rank *n* разряд; категория; класс
rapid *a* быстрый, скорый
rapidity *n* быстрота, скорость
rapid-setting *a* быстротвердеющий
rare *a* редкий
rare earths редкие земли
rare gas *n* инертный (благородный) газ

rate *n* скорость
rating *n* номинальная характеристика
ratio *n* отношение; пропорция
rationalize *v* выводить; приходить к заключению
raw *a* сырой, необработанный
raw-material *n* сырьё
ray *n* луч
rayon *n* искусственный шёлк
reach достигать
react *v* реагировать
record *n* запись, регистрация
record *v* записывать, регистрировать
recorder *n* записывающее устройство
recover *v* восстанавливать, извлекать
recovery *n* восстановление; извлечение
rectangle прямоугольник
rectangular *a* прямоугольный
rectification *n* очистка
rectifier *n* ректификатор
rectify *v* ректифицировать; очищать
recuperation *n* рекуперация
recuperator *n* рекуператор
recurrence *n* повторение, возвращение
recycle *n* повторный цикл
red *a* красный
redden *v* окрашивать в красный цвет
red heat красное каление
red-hot *a* нагретый до красного каления
redness *n* красное каление
redox *n* окисление-восстановление
redoxide *n* окислитель-восстановитель
reduce *v* восстанавливать, уменьшать
reducible *a* восстанавливаемый
reductant *n* восстановитель
reduction *n* восстановление, уменьшение
reduction gear редуктор, редукционная передача
reductive agent восстановитель
reclamation *n* регенерация
recognition *n* признание
recognize *v* признавать; узнавать
recall *v* напоминать; вспоминать
reference electrode электрод сравнения
reference substance вещество-эталон
refine *v* очищать, рафинировать; перерабатывать
refinery *n* нефтеочистительный завод
refinery gas нефтезаводской газ
reflect *v* отражать
reflection *n* отражение
reflectometer *n* рефлектометр
reflux *n* обратный поток; флегма; орошение
reform *v* переделывать, исправлять
refract *v* преломлять
refraction *n* преломление; рефракция
refractive index показатель преломления
refractometer *n* рефрактометр
refractory *a* огнеупорный; тугоплавкий
refractory brick огнеупорный кирпич
refractory clay огнеупорная глина
refrigerant *n* охлаждающее вещество

refrigerate *v* охлаждать
refrigeration *n* охлаждение
refrigerator *n* холодильник
refuel *v* пополнять запас топлива
refuse *v* отказываться
regain *v* получать обратно
regard *v* считать; рассматривать
regenerate *v* регенерировать
regeneration *n* регенерация
region *n* район; область; сфера
register *v* регистрировать
regular *a* правильный; закономерный
regularity *n* закономерность
regulation *n* регулирование; стабилизация
reinforce *v* усиливать; армировать
reinforced concrete *n* железобетон
reject *v* отклонять; отбрасывать
relate *v* относить; связывать
relation *n* отношение; связь
relationship *n* зависимость; связь
relative *a* относительный
relativity *n* относительность
relax *v* ослаблять
relaxation *n* ослабление, релаксация
relaxometer *n* релаксометр
release *v* освобождать; *n* выделение; освобождение
relevance *n* отношение к, уместность
relief *n* освобождение; снятие
relieve *v* снимать напряжение
remain *v* сохранять; оставаться
remainder *n* остаток
remarkable *a* замечательный
remedy *n* средство
remember *v* помнить
remote control дистанционное управление
removal *n* удаление; перемещение
remove *v* удалять, устранять
render *v* оказывать помощь
renewal *n* восстановление
repair *n* ремонт, исправление; *v* ремонтировать, исправлять
repeat *v* повторять
repeated *a* неоднократный
repel *v* отталкивать
replace *v* замещать
replacement *n* замещение
replica *n* отпечаток
report *n* сообщение, доклад; *v* сообщать
represent *v* представлять, изображать
representation *n* изображение; представление
reproduce *v* воспроизводить
reproduction *n* воспроизведение
repulse *v* отталкивать
repulsion *n* отталкивание
repulsive force сила отталкивания
request *n* просьба
require *v* требовать
requirement *n* требование, потребность
research *n* исследование, изучение
researcher *n* исследователь
resemblance *n* аналогия; сходство
resemble *v* быть похожим
residue *n* осадок
residue gas сухой газ
resin *n* смола; канифоль
resinoid *n* термоотверждающая смола
resist *v* сопротивляться
resistance *n* сопротивление
resistant *a* стойкий, устойчивый

resol *n* резольная смола
resolve *v* разлагать
resolving power разрешающая способность
resolution *n* разложение; разрешающая способность
resonance *n* резонанс
resources *n* ресурсы
respectively *adv* соответственно
respond *v* реагировать
response *n* ответная реакция
rest *n* покой; остаток
restoration *n* реставрации, восстановление
restore v восстанавливать
restrain *v* связывать; ограничивать
restrict v ограничивать, сдерживать
restriction *n* ограничение
result *n* результат, исход
resultant *n* конечный
result from вытекать из
result in *v* приводить к
retain *v* удерживать; сохранять
retard *v* замедлять
retardant *n* замедлитель, ингибитор
retardation *n* замедление
retest *n* контрольное испытание
reticular *a* сетчатый
retinol *n* ретинол
retort *n* реторта
retorting *n* дистилляция; перегонка в реторте
retract *v* сокращаться
return *v* возвращать; *n* возврат
reveal *v* обнаруживать, показывать
revelation *n* открытие; результат
reverse *a* обратный
reversible *a* обратимый
revival *n* возрождение
revive *v* возрождать
revolution *n* вращение
revolve *v* вращаться
rewind *v* перематывать
rhodium *n* родий
rhomb *n* ромб
ribbon *n* лента
rich *a* богатый, обильный
rid *v* избавлять
right *a* правый, правильный
rigid *a* жесткий
rigidity *n* жесткость, устойчивость
rigorous *a* строгий; точный
rim *n* маховик
ring *n* кольцо; *v* окружать
rinse *v* промывать, полоскать
ripe *a* зрелый; выдержанный
rise *v* увеличиваться, возрастать; *n* подъем, возрастание
rivet *n* заклепка
roasting *n* прокаливание
rock *n* горная порода
rock gas природный газ
rock phosphate фосфорит
rock-salt *n* каменная соль
rod *n* стержень; брус
roll *v* прокатывать
rolled steel листовая сталь
roller *n* валик; ролик
roller-mill *n* вальцовая мельница
roll sulphur черенковая сера
roof *n* крыша
room *n* место; комната
root *n* корень
rope *n* жгут
ropy *a* волокнистый
rosin *n* канифоль
rot *v* гнить
rotary kiln вращающаяся печь
rotate *v* вращаться
rotation *n* вращение
rotational *a* вращательный

rotator *n* ротатор
rotten *a* гнилой
rough *a* грубый; шероховатый
roughness *n* шероховатость
round *a* круглый
route *n* маршрут; путь; курс
routine *n* заведенный порядок
row *n* ряд
rub *v* тереть; полировать
rubber *n* каучук
rubidium *n* рубидий
ruby *n* рубин
ruby sulphur красный мышьяк
rude *a* грубый; сырой
ruin *v* разрушать
rule *n* правило; норма; критерий
rule out *v* исключать
rule of thumb практическое правило
run *n* эксперимент; *v* действовать, работать
running water водопроводная вода
runover *n* наплыв
rupture *n* разрыв; разрушение
rust *v* ржаветь; *n* ржавчина
rustless *a* нержавеющий
rust-proof *a* коррозионноустойчивый
ruthenium *n* рутений

S

saccharose *n* сахароза
safe *a* надежный; безопасный
safelight *n* некатиновый свет
safety *n* безопасность
sale *n* продажа
salicyl *n* салицил
salify *v* образовывать соль
saline *a* соленый; солевой
salt *n* соль
salt bed соляная залежь
salt brine рассол
salty *a* соленый
samarium *n* самарий
same *a* одинаковый
sample *n* образец; проба; *v* брать пробу
sampling *n* опробование
sand *n* песок
sand bath песчаная баня
sandblasting *n* пескоструйная очистка
sand-blowing *n* пескоструйная обработка
sandpaper *n* наждачная бумага
saponification *n* омыление
satisfy *v* удовлетворять
saturate *v* насыщать
saturation *n* насыщение
scale *n* масштаб, шкала, весы
scale beam коромысло весов
scandium *n* скандий
scar *n* рубец; царапина
scarlet *a* алый
scatter *v* рассеивать
scattering *n* рассеивание; дисперсия
schedule *n* график, расписание
scheme *n* схема; диаграмма
schist *n* сланец
scholar *n* ученый
science *n* наука
scientific *a* научный
scientist *n* ученый
scission *n* деление
scope *n* масштаб; диапазон; сфера
score *n* десяток
scissors *n* ножницы
scrap *n* металлический лом
scrape *v* скоблить
screen *n* экран; сито; решето
screw *n* винт

scrub *v* очищать; стирать
seal *n* запайка; печать; пломба; *v* запаивать; закрывать
seam *n* шов; сшивка; соединение
seamless *a* бесшовный
search *n* поиск; обследование
seasoning *n* сушка на воздухе; выдерживание
secondary *a* вторичный
section *n* секция; разрез; срез
sector *n* участок; часть
secure *v* закреплять, соединять
sediment *n* осадок
seed *n* семя; затравочный кристалл
seeding *n* затравливание (кристаллизация)
segregation *n* выделение
seizure *n* захват
select *v* выбирать
selection *n* выбор; селекция
selectivity *n* избирательность
selenide селенид
selenite ***n*** селенит
selenium ***n*** селен
self-ionization *n* самоионизация
self-oxidation *n* самоокисление
self-ignition самовоспламенение
semi-conductor полупроводник
semi-product *n* полупродукт
sense *n* смысл; значение
sensibility *n* чувствительность
sensitive *a* чувствительный
sensitivity *n* чувствительность
sensitizer *n* активатор
sensor *n* датчик
separable *a* раздельный
separate *v* разделять
separate *a* отдельный; отделенный
separation *n* разделение; выделение
separator *n* сепаратор
sequence *n* последовательность; чередование
series *n* серия; ряд
serve *v* служить
service *n* эксплуатация
set *n* набор; ряд
settle *v* осаждать; оседать
settlement *n* оседание
settling *n* осадка
sevenfold *a* семикратный
several *a* несколько
sew *v* спускать воду; осушать
sewage *n* сток; сточные воды
sewer *n* коллектор
sexangular *a* шестиугольный
shade *n* оттенок; тон
shadowing *n* экранирование
shake *v* трясти; встряхивать
shale *n* сланец
shape *n* форма
share *n* доля; часть; *v* делить
sharp *a* острый, резкий
sharpen *v* заострять; насекать
shatter *v* разрушать; дробить
shear *n* сдвиг, срез, смещение
sheet *n* лист; слой
shell *n* оболочка; скорлупа; корпус
shield *n* щит; экран
shift *n* перемещение; сдвиг; *v* перемещать
short *a* короткий, краткий
shortage *n* недостаток, нехватка
shovel *n* лопата
show *v* показывать
shrink *v* садиться, давать усадку
shrinkage *n* усадка; сжатие
side *n* сторона
side chain *n* боковая цепь
side reaction побочная реакция
sieve *n* сито, фильтр, решето
sign *n* знак, признак
signal *n* импульс, знак, сигнал

significance *n* значение
significant *a* важный, значительный
silica *n* кремнезем
silicate *n* силикат
silicium *n* кремний
silicon *n* кремний
silk *n* шелк
silver *n* серебро
similar *a* аналогичный, подобный
similarity *n* сходство, аналогия
simple *a* простой
simplicity *n* простота
simplification *n* упрощение
simplify *v* упрощать
simulation *n* имитация; моделирование
simultaneous *a* одновременный
single *a* единичный; простой
single bond простая связь
sink *v* погружать; *n* слив, сток; раковина
sinking *n* погружение; оседание
sinter *n* окалина; пек
sintering *n* спекание
site *n* место; участок
situation *n* положение, ситуация
sizable *a* значительный
size *n* размер; величина
sizing *n* разделение; калибровка
skeleton *n* скелет; каркас; остов
sketch *n* схема, чертеж
skim *n* окалина; шлак
skin *n* кожа; оболочка; пленка
slag *n* шлак
slate *n* шифер; сланец
slight *a* незначительный
slip *n* скольжение
sleeve *n* втулка; рукав
slope *n* наклон
slot *n* щель; отверстие
slot-machine *n* автомат
slow *a* медленный
small *a* небольшой, маленький
smash *v* разбивать, дробить
smell *n* запах
smelt *n* плавка
smog *n* смог
smoke *n* дым; копоть; *v* дымить, коптить
smoke-black *n* сажа
smooth *a* гладкий; ровный
smoothing *n* выравнивание
snow white цинковые белила
soak *v* пропитывать; смачивать
soaking *n* пропитывание
soap *n* мыло
soda *n* сода
sodium *n* натрий
soft *a* мягкий
softener *n* смягчитель; размягчитель
softening *n* размягчение
soil *n* почва
sol *n* золь
solar *a* солнечный
solid *a* твердый
solid electrolyte твердый электролит
solid fuel твердое топливо
solidification *n* затвердевание
solidify *v* затвердевать
solubility *n* растворимость
soluble *a* растворимый
solute *n* растворенное вещество
solution *n* раствор; растворение; решение
solvation *n* сольватация
solve *v* растворять; решать
solvent *n* растворитель
solvolysis *n* сольволиз
some *pron* несколько
somewhat *adv* отчасти
sonic *a* звуковой
soot *n* сажа; копоть
sorbate *n* сорбат

sorbent *n* сорбент
sorbite *n* сорбит
sorption *n* сорпция
sort *n* сорт; вид; класс; *v* сортировать; классифицировать
sound *n* звук, шум; *a* прочный, крепкий, доброкачественный
sour *a* кислый
source *n* источник
space *n* пространство; расстояние; космос
spare *a* запасной
spark *n* искра; вспышка
spatial *a* пространственный
spatula *n* шпатель
special *a* особый; специальный
species *n* вид; порода; образец
specific *a* специфический
specific gravity удельный вес
specification *n* инструкция
specimen *n* образец
spectra *n* спектры
spectral *a* спектральный
spectrochemical спектрохимический
spectrograph *n* спектрограф
spectrometer *n* спектрометр
spectrum *n* спектр
speed *n* скорость
spend *v* тратить; расходовать
sphere *n* сфера; шар; область
spherical *a* сферический
spin *n* спин
spirit *n* спирт
spitting *n* разбрасывание; разбрызгивание
split *v* расщеплять; раскалывать
spongy *a* губчатый; пористый
spontaneous *a* самопроизвольный
spool *n* бобина
spoon *n* ложка
spot *n* пятно; место
spray *v* разбрызгивать; *n* струя; брызги
sprayer *n* распылитель; пульверизатор
spread *v* распространять
spring *n* пружина; источник
square *n* квадрат; прямоугольник
squeeze *n* сжатие; сжимание
stability *n* устойчивость, стабильность
stabilize *v* стабилизировать
stabilizer *n* стабилизатор
stable *a* устойчивый, стабильный
stage *n* фаза; период; стадия; ступень
stain *n* пятно; краска; *v* красить
stainless steel нержавеющая сталь
stamp *n* штамп; клеймо
stand *n* штатив; кронштейн
standard *n* стандарт
standpoint *n* точка зрения
stannic *a* оловянный
star *n* звезда
starch *n* крахмал
start *n* начало; пуск
starting *n* пуск механизма
starting point отправная точка
state *n* состояние, положение
statement *n* заявление; положение
static *a* статический; неподвижный
stationary *a* стационарный; неподвижный
steady *a* устойчивый; спокойный
steam *n* пар
steam exhaust мятый пар; отработанный пар
steam-tight *a* паронепроницаемый
stearine *n* стеарин
steel *n* сталь
steep *a* крутой

step *n* этап, стадия
stepwise *a* ступенчатый
stereochemistry *n* стереохимия
stibium *n* сурьма
stick *n* палка; стержень
stiff *a* жесткий; негнущийся
stiff concrete жесткая бетонная смесь
stimulate *v* стимулировать
stir *v* мешать, перемешивать
stirrer *n* мешалка
stock *n* запас сырья
stock solution основной раствор
stone *n* камень
stop *v* прекращать; *n* остановка
stopper *n* пробка, заглушка
storage *n* склад; хранение
store *v* накапливать; хранить; запасать
stove *n* печь; сушильная камера
straight *a* прямой
strain *n* напряжение; деформация
stream *n* поток; течение; струя
strength *n* сила, прочность
stress *n* напряжение, усилие, *v* подчеркивать
stretch *v* тянуть; натягивать; простираться
strike *v* ударять
striking поразительный
strip *v* очищать
stripe ***n*** полоса
stripping *n* снятие покрытия
strong *a* сильный
strontia *n* окись стронция
strontium *n* стронций
structure *n* строение, структура
structural *a* структурный
stuff *n* материал; вещество; наполнитель
subdivide *v* подразделять
subject *n* предмет, тема; *v* подвергать воздействию
sublimate *n* сублимат; возгон
sublimation *n* сублимация; возгонка
submerge *v* погружать
subsequent *a* последующий
substance *n* вещество; материя
substituent *n* заместитель
substitute *v* заменять, замещать; *n* суррогат
substitution *n* замещение, замена
subtract *v* вычитать
succeed *v* удаваться
successive *a* последовательный
suck *v* всасывать, засасывать
sucrose *n* сахароза, тростниковый сахар
suddenly *adv* вдруг, внезапно
sufficient *a* достаточный
suffocation *n* удушье
sugar *n* сахар
suggest *v* предполагать
suitable *a* подходящий
sulphamide *n* сульфамид
sulphate *n* сульфат
sulphide *n* сульфид
sulphiting *n* сульфитирование
sulphoacid *n* сульфокислота
sulphonate *n* сульфонат
sulphur *n* сера
sulphuration *n* окуривание
sulphuric acid серная кислота
sulphurous acid сернистая кислота
sum *n* сумма
summary *n* резюме, итог
sum up *v* суммировать
sunflower oil иод-солнечное масло
sunproof *a* непроницаемый для солнца
supercharge *v* перегружать
supercooled *a* переохлажденный
superficial *a* поверхностный

superfine powder особостойкий порошок
superheated *a* перегретый
superimpose *v* накладывать; перекрывать
superoxide *n* перекись
superphosphate *n* суперфосфат
superposition *n* наложение; перекрытие
superior *a* высший; высшего качества
supersound *n* ультразвук
superviser *n* руководитель
supplement *n* добавление
supplementary *a* дополнительный
supply *n* подача питания; *v* снабжать, подавать
support *n* опора, поддержка; *и* поддерживать
suppose *v* предполагать
suppress *v* подавлять; глушить
suppression *n* подавление; устранение
surface *n* поверхность
surface activity поверхностная активность
surface tension поверхностное натяжение
surfactant *n* поверхностно-активное вещество
surging *n* пульсация; колебание
surplus ***n*** избыток
surround *v* окружать
surroundings *n* среда, окружение
susceptibility *n* чувствительность; восприимчивость
susceptible чувствительный; восприимчивый
suspend *v* взвешивать; суспензировать
suspension *n* суспензия
swell *v* разбухать, набухать; *n* набухание, разбухание
switch *n* выключатель
switch on *v* включать
switch off *v* выключать
swollen *a* набухший
symbol *n* символ; обозначение
symmetric *a* симметричный
symmetry *n* симметрия
synthesis *n* синтез
synthetic *a* искусственный
synthesize *v* синтезировать
system *n* система; установка, план
systematization *n* систематизация

T

table *n* таблица
tablet *n* таблетка
tabulate *v* табулировать; сводить в таблицу
tag *n* ярлык
tagging *n* маркировка, мечение
tagged element меченый элемент
take advantage of использовать
take into account учитывать
take part участвовать
take pictures фотографировать
take place происходить
take up *v* поглощать
talc *n* тальк
tall oil талловое масло
tamp *v* трамбовать
tan *v* дубить
tandem *n* тандем; последовательно расположенный
tangential *a* тангенциальный; касательный
tank *n* бак; резервуар
tanker *n* танкер; цистерна
tantalic acid танталовая кислота

tannage *n* дубление, дубильная кора
tannic acid дубильная кислота
tantalic *a* танталовый
tantalum *n* тантал
tap *n* кран; пробка
tape *n* лента, тесьма
tape recorder магнитофон
tar *n* деготь; смола
target *n* цель
tarnish *v* тускнеть
tarnishing *n* потускнение
tarry *a* смолистый
task *n* задача; цель
taste *n* вкус
tasteless *a* безвкусный
tautomer *n* таутомер
team *n* группа
tear *v* разрывать; *n* разрыв; износ
tear-proof *a* нервущийся
tear resistance сопротивление разрыву
technetium *n* технеций
technical *a* технический
technique *n* метод; способ
tedious *a* утомительный
telescope *n* телескоп
teletype *n* телетайп
telluric *a* теллуровый
tellurium *n* теллур
temper и закаливать
temperature *n* температура
tempering *n* закалка
temporary *a* временный
tenacious *a* вязкий, липкий
tenacity *n* вязкость
tendency *n* тенденция
tensile strength предел прочности; прочность на разрыв
tensile stress растягивающее усилие
tension *n* напряжение; натяжение
tentative *a* опытный; экспериментальный
terbium *n* тербий
term *n* термин; семестр; срок
terminal *a* концевой
terminate *v* ставить предел; ограничивать
termination reaction реакция обрыва цепи
ternary *a* тройной
terracotta *n* терракота
teroxide *n* трехокись
terrestrial *a* земной
tertiary *a* третичный
tertiary base третичное основание
test *v* проверять; испытывать; *n* проба; испытание
tester *n* испытательный прибор
testing *n* испытание, проверка
test-tube *n* пробирка
test-tube stand штатив
tetra-atomic *a* четырехатомный
tetrabasic *a* четырехосновный
tetrabromide *n* тетрабромид
tetrachloride *n* тетрахлорид
tetragonal *a* четырехугольный
tetrahedral *a* тетраэдрический
tetrahedron *n* тетраэдр
tetraoxide *n* четырехокись
textile *n* текстиль
texture *n* строение, структура
thanks to *prep* благодаря
thaw *v* таять, оттаивать
thawing *n* оттаивание
thaw point точка росы
thermochemistry *n* термохимия
thermodynamics *n* термодинамика
thermoelectric *a* термоэлектрический
thermometer *n* термометр
thermonuclear *a* термоядерный

thermoplastic *a* термопластический
thermostability *n* теплостойкость
thesis *n* диссертация; тезис
thiamide *n* тиамид
thick *a* толстый; плотный; густой
thicken *v* утолщать
thickness *n* толщина; густота
thin *a* тонкий; жидкий
thioacid *n* тиокислота
thioester *n* тиоэфир
thiosulphate *n* тиосульфат
thoria *n* окись тория
thorium торий
thorough *a* тщательный
though хотя
thread *n* нить; резьба
three-dimensional *a* трёхмерный
threefold *a* трёхкратный
three-neck flask трёхгорловая колба
three-step трёхступенчатый
threshold *n* порог; граница
thrill *n* дрожание, вибрация
throat *n* горло; горловина
throttle *n* дроссель
through *adv* через
throughput *n* пропускная способность
throw *v* бросать; *n* бросок, толчок
thrust *n* удар, толчок
thulium *n* тулий
tide *n* поток; течение; прилив
tie *v* связывать; *n* связь
tight *a* крепкий; прочный; непроницаемый
tile *n* черепица; плитка
timber *n* строительный материал
time *n* время; раз
time-dependent *a* зависимый от времени
time of exposure время экспозиции
time of fall время свободного падения
time-proof *a* долговечный, с большим сроком службы
time-table *n* расписание
time-tested *a* испытанный временем
timed *a* с выдержкой времени; хронометрированный
tin *n* олово
tin-coated *a* луженый
tinning *n* покрытие оловом; лужение
tint *n* оттенок, тон
tiny *a* крошечный, мельчайший
tinware *n* жестяная посуда
tip *n* наконечник, кончик, гребень
tissue *n* ткань
titanic *a* титановый
titanium *n* титан
titrate *v* титровать
titrating *n* титрование
titration *n* титрование
tolerance *n* допуск
tolerant *a* выносливый
tolerate *v* допускать
toluene *n* толуол
ton *n* тонна
tongs *n* щипцы; клещи
tongue *n* язык; шпунт
tonnage *n* тоннаж; вес в тоннах
tool *n* инструмент
tooling *n* механическая обработка; настройка
top *n* верхушка, верхняя часть
topaz *n* топаз
topography *n* топография
topping *n* покрытие; покрывающий слой; отгонка легких фракций

torch *n* факел; паяльная лампа
total *a* полный; общий
touch *v* касаться; соприкасаться
tough *a* прочный; жесткий; вязкий
toughen *v* придавать жесткость; придавать вязкость
toughness *n* жесткость; вязкость
tourmaline *n* турмалин
toward *prep* по направлению к
tower *n* башня
toxic *a* токсический; ядовитый
trace *v* прослеживать; *n* след
tracer *n* меченый атом; изотопный индикатор
tracer-labelling *n* мечение изотопным индикатором
tracing *n* прослеживание
track *n* след
trade *v* торговать; *n* торговля; профессия
trade-mark *n* фабричная марка
train *n* поезд; состав; серия; последовательный ряд
trajectory *n* траектория; путь
transfer *v* переносить; передавать; *n* перемещение; передача; перенос
transference *n* перемещение; перенос; передача
transform *v* преобразовывать; превращать
transformation *n* превращение
transformative *a* преобразовательный
transformer *n* трансформатор
transient *a* переходный; неустановившийся
transistor *n* полупроводниковый триод; транзистор
transit *n* прохождение; переход
transition *n* переход; превращение
transitional *a* переходный; нестационарный
transitive *a* переходный
translucence *n* просвечивание
translucent *a* просвечивающий; полупрозрачный
transmission *n* передача
transmission line линия передачи
transmit *v* передавать, посылать
transmittance *n* прозрачность
transmitter *n* трансмиттер; передатчик
transmitting *a* передающий; пропускающий
transmutation *n* трансмутация
transmute *v* превращаться
transparency *n* прозрачность
transparent *a* прозрачный
transport *n* транспорт; перенос; перемещение
transportation *n* перевозка, транспортировка
trap *v* улавливать; *n* ловушка, улавливатель
triple *a* тройной
triplet *n* триплет
tritium *n* тритий
trivalence *n* трехвалентность
trivalent *a* трехвалентный
trouble *n* нарушение; неисправность
trouble-free *a* безаварийный; бесперебойный
troublesome *a* ненадежный; доставляющий неприятности
true *a* истинный; точный; правильный
true solution истинный раствор
try *v* испытывать
tub *n* чан; сосуд
tube трубка
tubing *n* система труб**,** трубопровод; установка провода

tubular *a* трубчатый
tungsten *n* вольфрам
turbid *a* мутный
turbidity *n* мутность; помутнение
turbine *n* турбина
turn *n* оборот; поворот; *v* вращаться; поворачивать
turn into *v* превращать
turn out *v* оказываться
turn-over *n* оборот
twice *adv* дважды
twin *a* двойной
twist *v* скручивать, изгибаться
twofold *a* двукратный
type *n* тип; класс *n* шина

U

ultramarine *n* ультрамарин
ultrasonic *a* ультразвуковой
ultrasound ультразвук
ultraviolet ультрафиолетовый
unambiguous *a* однозначный
unbleached *a* небеленый, неотбеленный
unblended *a* несмешанный, без примеси
uncombined *a* свободный
undergo *v* подвергаться
underline *v* подчеркивать
undermine *v* подрывать
understand *v* понимать
undertake *v* предпринимать
uneven *a* неровный
unfit *a* негодный
uniaxial *a* одноосный
uniform *a* равномерный
unique *a* единственный в своем роде
unit *n* единица; установка
unity *n* единица; единство
unit cell элементарная ячейка
univalence *n* одновалентность
univalent *a* одновалентный
universal *a* универсальный
unless *conj* если не
unreliable *a* ненадежный
unsaturated *a* ненасыщенный
unshared *a* неспаренный
unstable *a* нестойкий, неустойчивый
upgrading *n* усиление; обогащение
upper *a* верхний
uranite *n* уранит
uranium *n* уран
urea *n* мочевина
urgency *n* срочность; неотложность
urgent *a* срочный
use *n* употребление, использование, *v* использовать
used-up *a* использованный; отработанный
useful *a* полезный; эффективный
usual *a* обычный
utility *n* полезность
utilization *n* использование
utilize *v* использовать

V

vacant *a* свободный; пустой
vacuum *n* вакуум; разряжение
valency *n* валентность
valent *a* валентный
valerianic acid валерьяновая кислота
valid *a* действительный; имеющий силу
validity *n* обоснованность

valuable *a* ценный
value *n* ценность; величина; число
valve *n* клапан; вентиль
vanadium *n* ванадий
vanish *v* исчезать, пропадать
vaporization *n* испарение; выпаривание
vaporize *v* испаряться
vaporizer *n* испаритель
vapour *n* пар
vapour-cooled *a* охлажденный парообразованием
vaporous *a* парообразный
vapour-proof *a* паронепроницаемый
variable *a* переменный; *n* переменная величина
variance *n* изменение; несоответствие
variant *n* вариант; видоизменение
variation *n* изменение; вариант; отклонение
variety *n* разнообразие; род; вид
various *a* разнообразный
varnish *n* лак; олифа; *v* покрывать лаком
varnishing *n* покрытие лаком
vary *v* менять
vast *a* обширный, огромный
vat *n* чан; бак; цистерна
vegetable *a* растительный
vegetation *n* растительность
vehicle *n* средство передвижения; связующее вещество
velocity *n* скорость
vent *n* отверстие
ventilating hood вытяжной шкаф
ventilation *n* вентиляция
ventilator *n* вентилятор
verge *n* край; граница
verification *n* проверка; контроль
verify *v* проверять
version *n* вариант
vertical *n* вертикаль
vertical line вертикальная линия
vessel *n* сосуд
via *prep* путем, через
vibrate *v* колебаться
vibration *n* колебание
vibration-proof *a* устойчивый к колебанию
vibrational *a* колебательный
vibrator *n* вибратор
vice versa *adv* наоборот
vicinity *n* соседство
view *n* вид; изображение
viewpoint *n* точка зрения
vigorous *a* сильный, бурный
vinegar *n* уксус
violate нарушать
violation *n* нарушение
violent *a* сильный; резкий
violet *a* фиолетовый; темнолиловый
virgin *a* свежий; первичный
virtual *a* фактический; действительный
viscose *n* вискоза
viscosimeter *n* вискозиметр
viscosity *n* вязкость
viscous *a* вязкий, густой
visibility *n* видимость
visible *a* видимый
visual *a* визуальный
vital *a* жизненный
vitality *n* жизнеспособность
vitamin *n* витамин
vitreous *a* стекловидный
vitrification *n* стеклование
vitrify *v* остекловываться
vitriol *n* купорос
vitriolization *n* обработка серной кислоты
void *n* пустота

void-free *a* плотный; без пустот
volatility *n* летучесть
volatile *a* летучий
volatilization *n* улетучивание; испарение
volatilize *v* улетучиваться, испаряться
volcanic *a* вулканический
volt *n* вольт
voltage *n* напряжение
volt-ampere *n* вольт-ампер
voltmeter *n* вольтметр
volume *n* объем
volumeter *n* волюметр
volumetric *a* объемный
voyage *n* путь
vulcanization *n* вулканизация
vulcanize *v* вулканизировать
vulcanizer *n* вулканизатор

W

wall *n* стена
wander *v* блуждать
want *n* недостаток; необходимость
ware *n* изделие
warm *a* теплый
warmth *n* теплота
warn *v* предупреждать
warning agent сигнальное вещество
warning colour сигнальная краска
wash *v* промывать, мыть; *n* промывка
waste *n* отходы
wasteful process неэкономический процесс
waste gas отработанный газ
waste minerals пустая порода
watch *v* наблюдать
water bath водяная баня
water gas водяной газ
waterproof *a* водонепроницаемый
watt *n* ватт
wave *n* волна; колебание
wavelength *n* длина волны
wax *n* воск
way *n* путь; способ
weak *a* слабый
weak base слабое основание
weaken *v* ослаблять
wealth *n* изобилие; богатство
wear *n* износ
wearproof *a* износоустойчивый
wear-resistant *a* стойкий к износу
weather *n* погода
weathering *n* разрушение в атмосферных условиях; выветривание
weigh *v* взвешивать
weight *n* вес, тяжесть
weld *v* сваривать
well *n* скважина; колодец
wet *a* мокрый; влажный; *v* смачивать
whatever *a* любой; какой бы ни
wheel *n* колесо; шестерня
whereas *adv* тогда как
white *a* белый
white hot нагретый добела
white lead свинцовые белила
whitewash *n* побелка
wire gauge проволочная сетка
withdraw *v* извлекать
withhold *v* удерживать; отказывать (в чем-л.)
within *prep* внутри; в
withstand *v* противостоять; выдерживать
without *prep* без
wolfram *n* вольфрам

wood *n* древесина
wood-alcohol *n* метиловый спирт
wood coal древесный уголь
work *n* работа; труд
workr *n* исследователь; рабочий
workshop *n* цех; мастерская
work out *v* разрабатывать
world *n* вселенная
worth *a* стоящий
wrap *n* обертка; *v* обертывать

X

X-axis *n* ось абсцисс
X-particle *n* мезон
X-ray *n* рентгеновые лучи
X-ray *v* облучать рентгеновыми лучами
X-ray tube рентгеновская трубка
xenon *n* ксенон

Y

yard *n* ярд
yarn *n* пряжа
yeast *n* дрожжи, закваска
yellow *a* желтый
yield *n* выход продукта; выпуск; *v* давать
yield-point *n* предел текучести
ytterbium *n* иттербий
yttrium *n* иттрий

Z

zero *n* нуль
zinc *n* цинк
zirconium *n* цирконий
zone *n* зона

Содержание

Для заметок

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