O‘ZBEKISTON RESPUBLIKASI OLIY TA’LIM, FAN VA INNOVATSIYALAR VAZIRLIGI

GULISTON DAVLAT UNIVERSITETI

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CHEMISTRY IN ENGLISH

O‘quv-uslubiy qo‘llanma

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Annotatsiya. Ushbu qo‘llanma kimyo muhandisligi oliy o'quv yurtlari talabalari uchun tuzilgan. Qo‘llanma 30 ta bo‘limdan iborat bo‘lib, ularning har birida ixtisoslikni hisobga olgan holda tanlangan matn (ilmiy uslubda tuzilgan va ichida maxsus kasbiy terminologiya mavjud). Har bir matndan keyin savollar beriladi, ularning maqsadi – talabalarning yangi materialni tushunishlarini tekshirishdan iborat. Bundan tashqari, har bir matndan keyin yangi bilimlarni amaliyotda qo'llash ko'nikmalarini rivojlantirishga yordam beradigan mashqlar keltirilgan. Har bir bo‘lim tanlangan mavzu bo‘yicha faol lug‘at (so‘zlar ingliz, rus va o‘zbek tilida berilgan) ro‘yxati bilan yakunlanadi. Qo'llanma talabalarga ingliz tilini maxsus maqsadlarda o'rganish (ESP), ilmiy va ilmiy-ommabop matnlardan kerakli ma'lumotlarni olish va ularni tahlil qilish, shuningdek, professional lug'atini va ilmiy nutq uslubiga xos bo'lgan asosiy sintaktik konstruktsiyalar bilan boyitish imkonini beradi.

Abstract. This textbook was compiled for students of chemical engineering universities. The textbook consists of 30 units, each of which contains a text selected taking into account the specialty (made in a scientific style and contains special professional terminology). Each text is accompanied by questions to the text, the purpose of which is to test students' understanding of the new material. In addition, each text is accompanied by exercises that contribute to the development of skills in applying new knowledge in practice. Each unit ends with a list of words (English, Russian and Uzbek) included in the active vocabulary on the selected topic. The manual allows students to master English for special purposes (ESP), learn how to extract the necessary information from scientific and popular science texts, and also enrich their vocabulary with basic syntactic constructions characteristic of the professional and scientific style of speech.

Аннотация. Данное учебное пособие составлено для студентов химико-технологических вузов. Учебное пособие состоит из 30 юнитов, в каждом из которых содержится текст, подобранный с учётом специальности (выполнен в научном стиле и содержит специальную профессиональную терминологию). К каждому тексту прилагаются вопросы к тексту, целью которых является проверка понимания учащимися нового материала. Кроме того, к каждому тексту прилагаются упражнения, способствующие развитию умений и навыков применения новых знаний на практике. Каждый юнит заканчивается перечнем слов (английский, русский и узбекский вариант), входящих в активный вокабуляр по выбранной теме. Пособие позволяет студентам овладеть английским языком для специальных целей (ESP), научиться извлекать из научных и научно-популярных текстов необходимую информацию, а также обогатить свой лексический запас основными синтаксическими конструкциями, характерными для профессионального и научного стиля речи.

INTRODUCTION

In the scope of its subject, chemistry-technology area occupies an intermediate position between physics and biology. It is sometimes called the central science because it provides a foundation for understanding both basic and applied scientific disciplines at a fundamental level.

The following teaching manual has been created during several years of teaching English for chemists and technologists at the Yangiyer branch of Tashkant State Chemical-Technological Institute and is therefore designed to meet the needs of the students of these specialities.

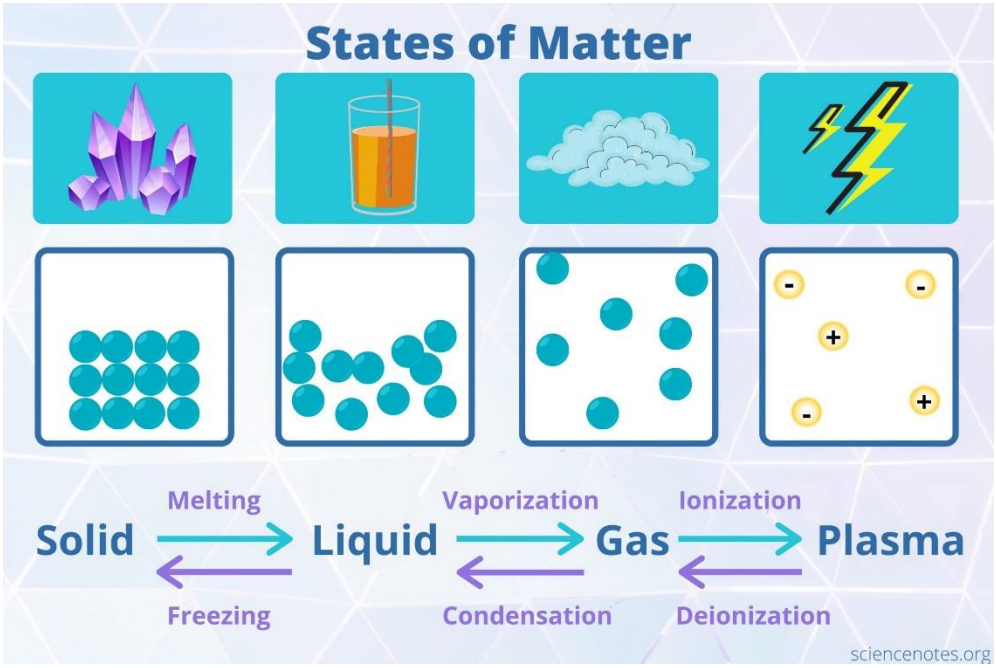
Language is our primary source of communication. It is the method through which we share our ideas and thoughts with others. The main motivation was the lack of appropriate materials, especially as the groups generally comprise students with a very diverse level of English. This diversity therefore became the main criterion determining both the form and the content of this teaching manual.

In the 30 units that provide material for English course, the emphasis is put on teaching the students vocabulary and terminology, which is introduced via authentic texts, depending on the topic of each unit. Students are encouraged to learn the meaning of new words in context. Grammar is included too, with the aim of demonstrating and explaining grammatical rules by means of examples taken directly from the texts. For the more advanced students, grammatical exercises in this material can serve for revision while the beginners might need more supplementary materials.

We, as authors, hope that this teaching manual, the preparation of which has been a challenging as well as enjoyable experience, will be useful for the teachers and students of chemical-technological area.

UNIT 1

TEXT



Everything on Earth is made up of matter, that is, of elements and of the compounds they form. Matter is everything that you can touch/see/feel or smell. Chemistry is the study of matter and the changes that take place within that matter. There are three main states of matter: solids, liquids and gases. Each of these states is also known as a phase. A solid is matter with a rigid shape and a fixed volume that does not change much with temperature. A liquid has a fixed volume but not a fixed shape and it takes the shape of its container. Its volume may alter with changes in temperature and pressure. A gas has neither fixed volume nor shape, as it expands to fill its container completely. Its volume is very sensitive to temperature and pressure. Matter is composed of different kinds of atoms. An atom is made up of electrons, protons and neutrons. Protons and neutrons are in the nucleus, the centre of the atom. Electrons spin very quickly around the nucleus. Electrons have a negative charge, protons have a positive charge and neutrons have no charge. The number of protons always equals the number of electrons in an atom, so the atom is neutral. If some electrons are added or removed, the atom becomes

charged and is then an ion. A molecule is a particle containing two or more atoms chemically bonded together. Matter has physical and chemical properties. Physical properties include density, melting point, boiling point, freezing point, colour or smell. An example of chemical properties is the way elements combine with each other in reactions. An element is matter that consists of only one kind of atom. A compound is a substance consisting of two or more chemically bonded elements, with a fixed ratio determining the composition. Elements and compounds can move from one phase to another when special physical forces are present. One example of those forces is temperature. When temperature changes, the phase can change. You can see water vapour over a boiling pot of water. That vapour (or gas) can condense and become a drop of water. If you put that drop in the freezer, it becomes a solid. No matter what phase it is in, it is still water. It still has the same chemical properties.

QUESTIONS:

1. Why do you think it is important to study chemistry?
2. What is METTER?
3. What is electrons?
4. What is protons?

EXERCISES:

1. What am I? Choose from: *electron, ion, neutron, nucleus, proton.*

a. I'm the centre of the atom, I contain protons and neutrons. I'm the ...

b. I move around the nucleus. I'm an ...

c. I'm positively charged. I'm a ...

d. I've no charge. I'm a ...

e. I’m an electrically charged atom. I’m an ...

2. Use *how, how many, what, which* to complete the questions.

a. ... is matter?

b. ... can matter exist?

c. ... of the three states of matter have a fixed shape?

d. ... of them have no fixed volume?

e. ... are atoms made up of?

f. ... of the constituents of an atom are outside the nucleus?

g. ... are the properties of matter classified?

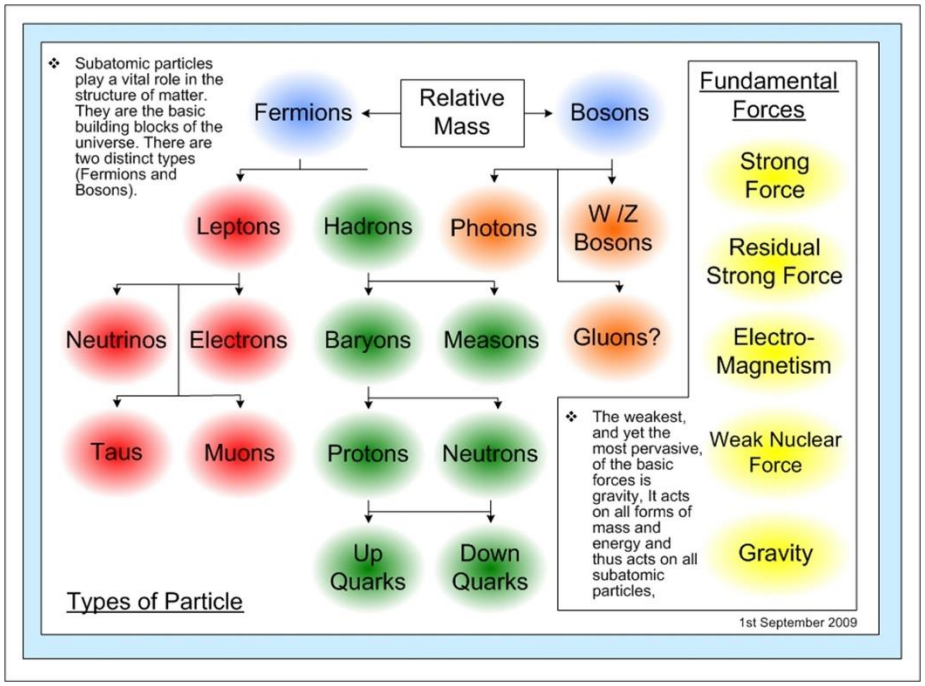
h. ... kinds of atoms are there in an element?

ACTIVE VOCABULARY:

English	Uzbek	Russian
Earth	Yer	Земля
Atom	Atom	Атом
Temperature	Harorat	Температура
Chemical	Kimyoviy	Химический
Electron	Elektron	Электрон
Neutron	Neytron	Нейтрон
Proton	Proton	Протон
Matter	Modda	Материя
Molecule	Molekula	Молекула
Ion	Ion	Ион

UNIT 2

TEXT



Elements are the building blocks of matter. An element is a substance that contains only one type of atom and which cannot be broken down chemically. When different elements have a reaction, atoms form chemical bonds with other atoms and create compounds. Therefore, a compound is a substance that is made up of two or more different elements which are chemically bonded together. The formation of a compound involves a chemical reaction. In compounds, bonds are formed and broken down by chemical forces. Compounds cannot be broken down by physical forces. The properties of a compound are often totally different from the properties of the original elements. For example, sodium alone is very reactive, but when it combines with chlorine (another reactive element) they form a non-reactive substance called sodium chloride (salt: NaCl). The compound has none of the traits of the original elements. Ionic and covalent bonds hold the atoms of the elements together. In ionic bonding, atoms lose or gain electrons to form charged particles (ions) which are strongly attracted to one another. In covalent bonding, atoms share electrons with other atoms. Scientists have found it very useful to give symbols to the different elements.

The symbol consists of one or two letters taken from the Latin or English name for the element. The formula for a compound is made using the symbols of the elements in the compound. It tells you which elements the compound is made from and how much of each element there is in it. Mixtures are usually how you find things in nature. A mixture is a system of two or more distinct chemical substances. The components in a mixture retain their individual chemical properties. Unlike compounds, mixtures can be separated by physical means (distillation, crystallization, etc.). Heterogeneous mixtures have distinguishable phases. Homogeneous mixtures are those in which the atoms or molecules are interspersed, as in a mixture of gases. Solutions are homogeneous mixtures. They can be solids, liquids, or gases dissolved in liquids, or also gases dissolved in other gases. The solute is the substance being dissolved; the solvent is the one doing the dissolving. Water is a very common solvent.

QUESTIONS:

1. What are the building blocks of matter?
2. What is the formation of a compound involves?
3. What is mixture?

EXERCISES:

1. What am I? Choose from: *compound, element, formula, reaction, salt, solution, symbol, water.*

a. I’m a substance that consists of only one type of atom. I’m an ...

b. I’m one or two letters representing a chemical substance. I’m a ...

c. I’m a substance consisting of two or more elements chemically combined. I’m a ...

d. I’m a set of letters and numbers showing the elements that a substance is made of. I’m a ...

e. I’m the chemical change caused in a substance when it combines with another. I’m a ...

f. I’m a mixture of a solute and a solvent that does not separate out. I’m a ...

g. I’m the solute in salt water. I’m ...

h. I’m the solvent in salt water. I’m ...

2. Complete the sentences using the appropriate passive forms of these verbs: *break down, form, hold, make up, take.*

a. Matter ... of elements.

b. Compounds ... by elements.

c. Symbols ... from Latin or English words.

d. The atoms of the elements ...together by covalent and ionic bonds.

e. Chemical bonds are formed and ... by chemical forces.

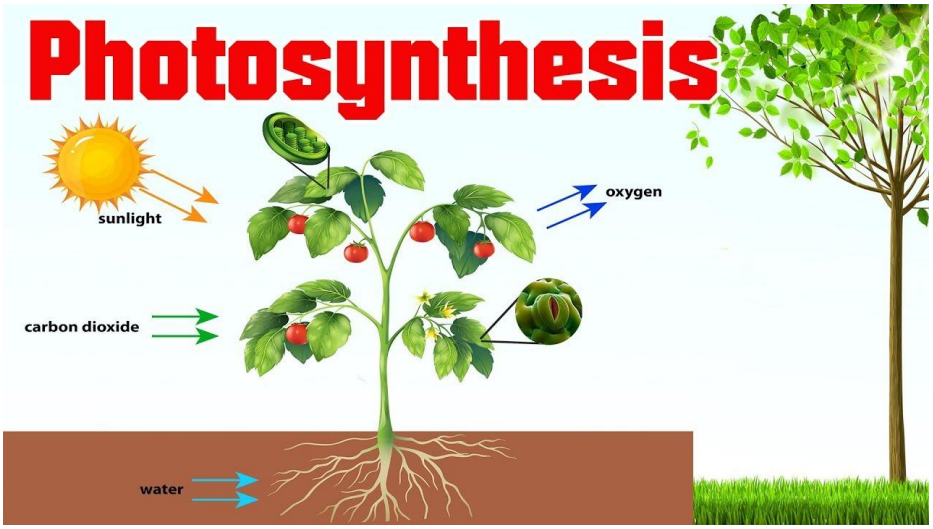
ACTIVE VOCABULARY

English	Uzbek	Russian
Building blocks	Qurilish bloklari	Строительные блоки
Bonds	Ulanish	Связь
Broken down	Buzilgan	Разбитый
Hold	Tutmoq	Держать
Gain	O'sish	Прирост

Retain	Tutmoq	Удерживать
Distinguishable	Turli	Отличительный
Interspersed	Kiritilgan	Внесенный
Liquid	Suyuqlik	Жидкость
Gas	Gaz	Газ
Substance	Modda	Субстанция
Solvent	Eritkich	Растворитель

UNIT 3

TEXT



Whenever elements combine to form a compound, a chemical reaction takes place. A chemical reaction is a change in which one or more chemical elements or compounds (the reactants) form new compounds (the products). In a chemical reaction, a chemical change must occur, but atoms are not lost nor made. Chemical reactions are determined by the laws of thermodynamics. Reactions can be exothermic (e.g. precipitation and crystallization) in which energy – usually in the form of heat – is given out to the surroundings, or endothermic, in which energy is taken in. Chemical reactions can be classified into a few categories. The simplest is

probably synthesis, where two or more simple compounds combine to form a more complicated one. The opposite of synthesis is decomposition, where a molecule breaks down to make several simpler ones. Redox (reduction-oxidation) reactions involve the change of an oxidation number, or transfer of electrons among the reacting substances. Reduction is the removal of oxygen from a substance. Oxidation is the gain of oxygen by a substance. The reducing agent – the compound that loses electrons – is said to be oxidized; the oxidizing agent – the compound that gains electrons – is said to be reduced. An important class of redox reactions are the electrochemical reactions. Acid-base reactions involve the transfer of protons from an acid (donor) to a base (acceptor). Acids and bases are encountered frequently both in chemistry and in everyday living. Certain fruits contain citric or ascorbic acid (vitamin C), carbonated beverages contain carbonic acid and vinegar contains acetic acid. Soap and detergents, household ammonia, and lye (caustic soda) are common bases. Acids and bases have opposite properties and have the ability to cancel or neutralize each other producing water and a salt (neutralization reaction). Amphoteric substances can act as either acids or bases (water). Litmus paper is one of the oldest methods used to test the acidity or basicity of a solution. Blue litmus paper turns red when put in an acidic solution. Red litmus paper turns blue when put in a basic solution. Scientists use the pH scale (pH stands for “potential of hydrogen”) to measure how acidic or basic a liquid is. The scale goes from 0 to 14. Neutral substances (e.g. distilled water) have pH 7, acids have pH between 0 and 7, bases from 7 to 14. The main example of photochemical reactions is photosynthesis, a chemical process in which most plants use solar energy to convert carbon dioxide and water into glucose, disposing of oxygen as a side-product. The rate of a reaction – which is the speed at which a reaction happens – is affected by concentration, temperature and pressure. Reactions need a specific amount of energy to happen. The minimum amount of energy needed to make a reaction happen is called the activation energy. A catalyst lowers the activation energy so that a reaction can

happen more easily. Enzymes are biological catalysts. Inhibitors slow the rate of reaction and sometimes they can stop the reaction completely.

QUESTIONS:

1. What is photosynthesis?
2. What is oxidation?
3. What is reduction?

EXERCISES:

1. Using the prompts below, ask questions

a. What / chemical reaction / be?

b. When / a chemical reaction / take place?

c. What / reactants / be?

d. What / the products / be?

e. What / redox reactions / be?

f. Which / the reducing agent / be?

g. Which / the oxidizing agent / be?

h. What / in acid-base reactions / happen?

i. What / photosynthesis / be?

j. What / the rate of a reaction / be affected by?

k. What / activation energy / be?

l. How / catalysts and inhibitors / affect reaction rates?

2. Answer the questions TRUE or FALSE

a. Atoms aren’t lost or made in chemical reactions.

b. Atoms join together to make compounds.

c. Atoms make up everything in the universe.

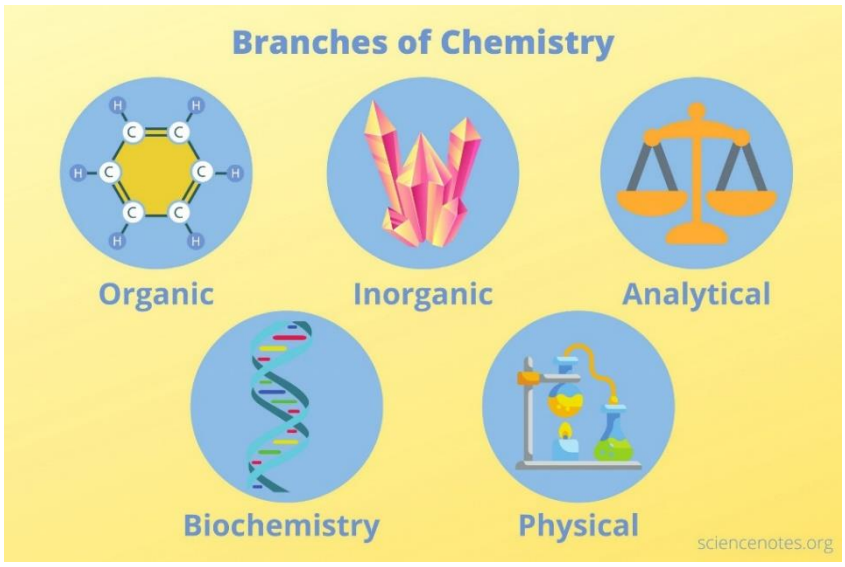
d. The periodic table puts elements with similar properties together.

ACTIVE VOCABULARY

English	Uzbek	Russian
Photosynthesis	Fotosintez	Фотосинтез
Oxidation	Oksidlanish	Окисление
Reduction	Kamaytirish	Снижение
Energy	Energiya	Энергия
Catalyst	Katalizator	Катализатор
Classified	Malakali	Квалифицированный
Inhibitors	Ingibitorlar	Ингибиторы
Reaction	Reaktsiya	Реакция
Speed	Tezlik	Скорость
Litmus paper	Lakmus qog'ozi	Лакмусовая бумага
Important	Muhim	Важный
Soap	Sovun	Мыло
Solar energy	Quyosh energiyasi	Солнечная энергия
Specific	Maxsus	Специфический
Acetic acid	Sirka kislotasi	Уксусная кислота

UNIT 4

TEXT



Chemistry is divided into several main sub-disciplines.

Organic chemistry is the study of the structure, properties, composition, mechanisms and reactions of organic compounds, which are compounds based on a carbon skeleton. In other words, organic chemistry is the study of the chemistry of life.

Biochemistry is the study of the chemicals, chemical reactions and chemical interactions that take place in living organisms.

Biochemistry and organic chemistry are closely related. Biochemistry is also associated with molecular biology and genetics. Inorganic chemistry is the study of properties and reactions of compounds which do not contain a carbon-hydrogen bond. Many inorganic compounds are those which contain metals. The distinction between organic and inorganic disciplines is not absolute and there is much overlap.

Analytical chemistry is the analysis of substances to gain an understanding of their chemical composition and structure. It is divided into two main branches: qualitative analysis and quantitative analysis. Qualitative analysis identifies the types of elements and compounds that make up substances. Quantitative analysis measures the amounts of the different chemicals that make up substances.

Physical chemistry is the branch of chemistry that applies physics to the study of chemistry. Important areas of study include chemical thermodynamics, chemical kinetics, electrochemistry, statistical mechanics, and spectroscopy. Physical chemistry is usually associated with quantum chemistry and theoretical chemistry.

Nuclear chemistry deals with radioactivity, nuclear processes and nuclear properties.

Materials chemistry is an inter-disciplinary field which consists of studying the structure and properties of existing materials, creating and characterizing new materials. It uses advanced techniques to predict structures and properties of materials that have not yet been realized.

QUESTIONS:

1. What is organic chemistry?
2. What is biochemistry?
3. What is inorganic chemistry?
4. What is analytical chemistry?
5. What is physical chemistry?

EXERCISES:

1. Join the heads and tails into a summary of the reading passage.

Heads

a. Organic chemistry	**d.** Analytical chemistry	**g.** Physical chemistry
b. Biochemistry	**e.** Qualitative analysis	**h.** Nuclear chemistry
c. Inorganic chemistry	**f.** Quantitative analysis	**i.** Materials chemistry

Tails

1. …deals with the identification of the constituents of a substance.

2. …determines the constituents of substances.

3. …determines the amount of each constituent present in the substance.

4. …is concerned with the physical properties of chemical substances and includesthe applications of thermodynamics and quantum mechanics to chemistry.

5. …is the preparation, classification, and understanding of substances with a useful function.

6. …is the study of carbon and its compounds.

7. …is the study of chemical processes that occur inside living organisms.

8. …is the study of chemical substances that do not contain carbon-to-carbon bonds.

9. …studies nuclear reaction and its products.

ACTIVE VOCABULARY

English	Uzbek	Russian
Biochemistry	Biokimyo	Биохимия
Inorganic chemistry	Noorganik kimyo	Неорганическая химия
Analytical chemistry	Analitik kimyo	Аналитическая химия
Physical chemistry	Fizik kimyo	Физическая химия
Organism	Organizm	Организм

Branch	Soha	Ветвь
Quantitative analysis	Miqdoriy tahlil	Количественный анализ
Qualitative analysis	Sifatli tahlil	Качественный анализ
Nuclear	Yadroviy	Ядерный
Compound	Qo‘shilma, birlashma	Соединение
Radioactivity	Radioaktivlik	Радиоактивность
Inter-disciplinary	Fanlararo	Междисциплинарный
Structure	Tarkibi / tuzilishi	Состав / структура
Include	O'z ichiga olmoq	Включать
Living organism	Tirik organizm	Живой организм

UNIT 5

TEXT

Credit for the discovery of oxygen is shared by two men, Joseph Priestley, an English clergyman and amateur scientist, who later moved to the United States to escape religious persecution, and Carl Wilhelm Scheele, a Swedish pharmacist. Working

independently, these two men both obtained the gas which we know as oxygen by heating various compounds of the element, particularly mercuric oxide. They also found evidence that this gas is a component of the atmosphere. Priestley's work was published in 1774, but although Scheele's experiments had probably been performed even earlier, their publication was delayed and no account of them appeared until 1777. Though Priestley recognized that the gas which he had discovered plays an important role in combustion, he remained, along with Scheele, an ardent adherent of the phlogiston theory of combustion; in fact, he called the gas dephlogisticated air. On the basis of the experimental results of Priestley, Scheele, and others, as well as some very fine experimental work of his own, in 1777the brilliant zrench chemist Lavoisier established the modern concept that the combustion of a substance consists in its combination with the new gas which Priestley and Scheele had described, and which Lavoisier found an important constituent of the atmosphere. Since the combustion of many substances (now known as non-metals) such as phosphorus and sulphur yields products which react with water and give acidic solutions, Lavoisier named this gas oxygen, derived from Greek words meaning acid former. Oxygen occurs in the free state as the second most abundant component of the atmosphere; about one-fifth of the air by volume is oxygen. In the combined state it makes up 88.81% by weight of pure water, and, on the average, 85.79% of sea water. It occurs in the earth's crust, in the form of a multitude of compounds, to the estimated extent of 46.43%. Oxygen is one of the most abundant elements. It forms 21 per cent of the atmosphere, 89 per cent of the water, and about 50 per cent of the earth's crust. Without oxygen, life cannot exist, as well as fire. Oxygen is essential in supporting respiration and combustion; it is used in many modern industrial processes.

QUESTIONS:

1. What famous scientists worked on the discovery of oxygen?
2. Who was the first to obtain this gas?

3. What was the method of obtaining oxygen?

4. What theory of combustion existed in Priestley's time?

5. What does the word *oxygen* mean?

EXERCISES:

1. Fill in the blanks with prepositions and conjunctions where necessary: *of, by, in, about, as well as, and, on*

1. Scheele ... Priestley obtained ... oxygen ... heating various compounds ... the element. 2. Priestley recognized that the gas obtained ... him plays an important role … combustion. 3. Priestley... Scheele remained adherent ... the phlogiston theory ... combustion. 4. ... the basis ... the experimental results ... the earlier workers Lavoisier established his own concept ... combustion. 5. The combustion ... a substance consists ... its combination with oxygen. 6. Oxygen occurs ... the free state ... the atmosphere. 7. ... one-fifth ... the air ... volume is oxygen.

2. Define the meaning of the assigned words by context.

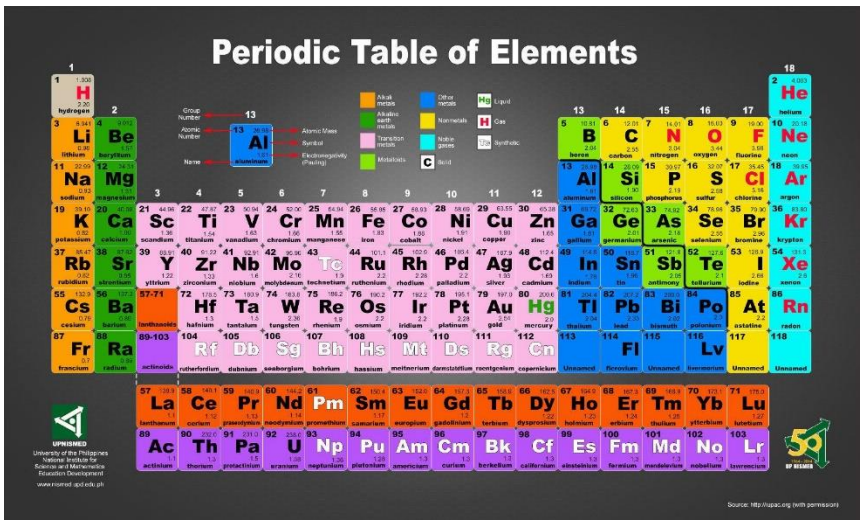
1. ***Water*** is a compound with the formula H2O. 2. Oxygen supports ***combustion***. 3. A gas which has no colour and odour is called colourless and odourless. 4. One litre of water at 0°C dissolves 48.9 ml of oxygen gas at 1-atm pressure. 5. The ***boiling*** point of water is 100°C. 6. Water ***freezes at*** 0°C. 7. Above 0°C water is ***liquid*** and below 0°C it is solid. 8. Heating potassium chlorate is followed by the evolution of oxygen. 9. When water is boiling, it is ***evaporating***. 10. Oxygen is ***stored*** in steel cylinders. 11. When the reaction proceeds very ***quickly***, we usually say that its rate is high. 12. In the laboratory oxygen is obtained by heating KClO3, and commercially it is made by the ***distillation*** of liquid air. 13. Oxygen ***is soluble*** in water very little.

ACTIVE VOCABULARY|:

English	Uzbek	Russian
Oxygen	Kislorod	Кислород
Water	Suv	Вода
Freezing	Muzlash	Замерзание
Evaporating	Bug'lanish	Испарение
Combustion	Yonish	Горение
Colourless	Rangsiz	Бесцветный
Quickly	Tezda	Быстро
Stored	Saqlangan	Сохранённый
Issoluble	Erimaydigan	Неразрешимый
Distillation	Distillash	Дистиляция
Boiling	Qaynatish	Кипение
Atmosphere	Atmosfera	Атмосфера
Chlor	Xlor	Хлор
Volume	Hajmi	Объём
Chemist	Kimyogar	Химик

UNIT 6

TEXT



Periodic Table is a chart which arranges the chemical elements in a useful and logical manner. Elements are listed in order of increasing atomic number, lined up so that elements which exhibit similar properties are arranged in the same row or column as each other. The Periodic Table is one of the most useful tools of Chemistry and other sciences. Russian Dmitri Mendeleev was the first scientist to create the periodic table from which the modern table is derived. The main difference between the modern periodic table and Mendeleev's one is that the latter arranged the elements in order of increasing atomic weight, while the modern table orders the elements by increasing atomic number. The IUPAC (International Union of Pure Applied Chemistry) revises the periodic table as new data become available. There are about 100 elements on the periodic table that occur in nature. All of the other elements are man-made. The present periodic table has room for 119 elements, although a few elements await verification of their discovery. Scientists are working on creating and verifying element 120, which will change the appearance of the table. Each element in the periodic table is identified by a chemical symbol. The elements are classified according to the following features: Atomic Number: the number of protons in the nucleus; –Atomic Mass: the sum of the number of protons plus neutrons in the nucleus; – Group: groups are columns or multiple columns in

the periodic table. Elements within a group share several common chemical and physical properties and often have the same outer electron arrangement. Period: periods are the rows from left to right in the period table. Elements in a period have the same number of energy shells. The elements can be divided into three categories that have characteristic properties: metals, non-metals and semimetals, or metalloids. Metals are generally shiny, malleable, ductile and good conductors of heat and electricity; non-metals are dull and poor conductors, and semimetals, or metalloids, have the properties of metals and non-metals, depending on the conditions. Most elements are metals.

QUESTIONS:

1. What is Periodic Table?
2. What was the first scientist to create the periodic table?
3. What is the atomic number?

EXERCISES:

1. Use the words in the box to complete the definitions below: *atomic number, chemical property, electron, groups, periods, physical property*

1. The horizontal rows of the periodic table are called ... 2. The vertical rows of the periodic table are called ... 3. An ... is the negatively charged subatomic particle found in the space about the nucleus. 4. The ... is the number of protons in the nucleus of an atom of an element. 5. A ... is a characteristic which can be recognized without changing a substance chemically. 6. A ... is a characteristic depending on the way a substance reacts with other substances.

2. Write the full name of the elements: *calcium, carbon, chlorine, copper, fluorine, gold, hydrogen, iron, lead, mercury, nitrogen, oxygen, potassium, silver, sodium, sulphur.*

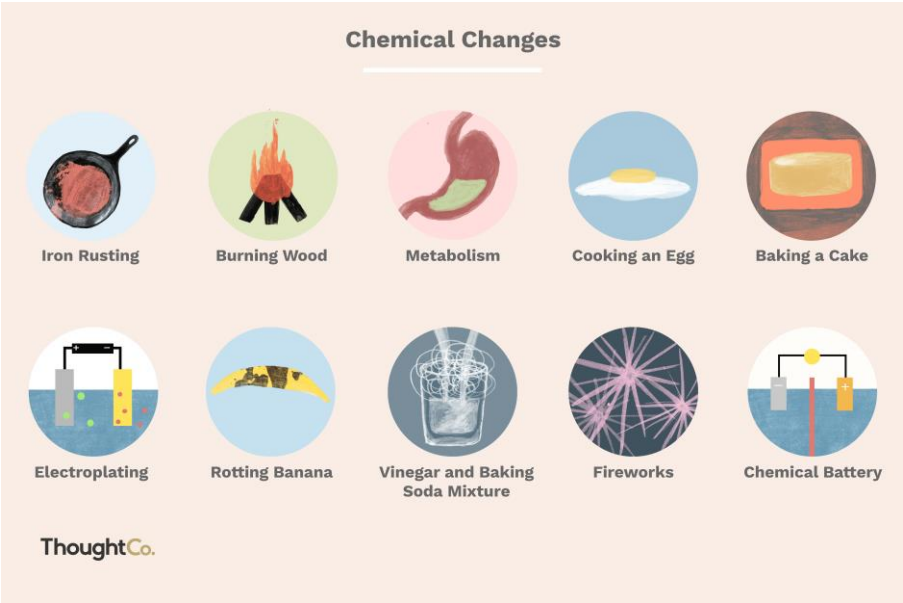
1.Au ...	5.Cl ...	9.H ...	13.Na ...
2.Ag ...	6.Cu ...	10.Hg ...	14.O ...
3.C ...	7.F ...	11.K ...	15.Pb ...
4.Ca ...	8.Fe ...	12.N ...	16.S ...

ACTIVE VOCABULARY:

English	**Uzbek**	**Russian**
Gold	Oltin	Золото
Sulphur	Oltingugurt	Сера
Calcium	Kaltsiy	Кальций
Carbon	Uglerod	Углерод
Chlorine	Xlor	Хлор
Copper	Mis	Медь
Fluorine	Ftor	Фтор
Iron	Temir	Железо
Lead	Qo'rg'oshin	Свинец
Mercury	Simob	Ртуть
Nitrogen	Azot	Азот
Potassium	Kaliy	Калий
Sodium	Natriy	Натрий

UNIT 7

TEXT



A chemical reaction, or chemical change, is a process in which the reactants (the starting materials) have different physical and chemical properties from the products (the newly formed substances). During chemical reactions, atoms are rearranged but they are not lost nor gained. The speed at which a chemical reaction occurs is called chemical reaction rate. Chemical reaction rates increase or decrease according to factors including temperature, pressure and light. Activation energy is the external energy that has to be added in order for a chemical reaction to occur. A catalyst lowers the activation energy so it speeds up the reaction. It is not used up during the reaction, and is chemically unchanged after the reaction has finished. The changes that take place in substances may be physical or chemical. Physical changes only change the appearance of a substance, i.e. they affect the physical properties of a substance, not its chemical composition. They can be caused by physical actions, such as changing temperature or pressure. Chemical changes cause a substance to change into a new substance with a new chemical formula, i.e. they affect the chemical properties of a substance. Matter has physical and chemical properties. A physical property is a characteristic that may be observed and measured without changing the chemical

identity of the specimen. Physical properties include density, melting point, boiling point, freezing point, colour and smell. A chemical property is a characteristic or behaviour of a substance that may be observed when it undergoes a chemical change or reaction. Chemical properties include characteristics such as pH, flammability, heat of combustion, toxicity, etc. A chemical equation is a symbolic representation of a chemical reaction, which involves the molecular or atomic formulas of reactants and products. There are several different types of chemical reactions and more than one way of classifying them. Here are some common reaction types. Combination or Synthesis Reactions are chemical changes in which two or more elements/compounds combine to form a more complex product (a compound). Decomposition Reactions are chemical changes where one compound decomposes or breaks down into two or more simpler products (elements). Substitution or Single-Replacement Reactions are chemical changes where an uncombined element replaces a less reactive element in a compound, creating a new compound and a single element. Double-Replacement Reactions, also called Double-Displacement Reactions, are chemical changes where two compounds exchange bonds or ions in order to form different compounds. Acid Base Reactions, also called Neutralisation Reactions, involve the reaction between an acid and a base, which combine to give salt and water. Combustion Reactions are redox reactions in which a combustible material combines with an oxidizer to form oxidized products and generate heat (exothermic reaction). In a combustion reaction, oxygen usually combines with another compound to form carbon dioxide and water. In a redox reaction, elements experience a change in oxidation number. They may involve the transfer of electrons between chemical species. Precipitation Reactions are aqueous reactions that involve the formation of a solid precipitate.

QUESTIONS:

1. What chemical reactions do you observe every day in everyday life?
2. What chemical reactions do you know?
3. What is a chemical change?

EXERCISES:

1. Which of these words can be used instead of the words in italics in this abstract of the first part of the reading passage? *change* • *consumed* • *extinguished* • *generate* • *handling* • *'ingredients'* • *jointly* • *manifest* • *material* • *observing* • *preserved* • *produced*• *symbolised* • *velocity* • *produced*

A chemical reaction is a *process* (1) involving the transformation of a *substance* (2) (or substances) into another. Mass is *conserved* (3) in a chemical reaction. No atoms are *created* (4) or *destroyed* (5). The reactants are the starting *materials* (6) for a chemical reaction. The substances that react *together* (7) in the reactions are called the reactants; the substances that are *formed* (8) are called the products. Chemical reactions vary in *speed* (9). Catalysts speed up reactions without being *used up* (10). Physical changes do not *produce* (11) a new substance whereas chemical changes produce a new substance. Physical properties can be observed by *viewing* (12) or *touching* (13) a sample. Chemical properties become *evident* (14) when the material undergoes a chemical reaction. Chemical reactions can be *represented* (15) using equations.

2. Match the words (A) with the appropriate definition (B)

A	B
Chemical Reaction	Are aqueous reactions that involve the formation of a solid precipitate
Precipitation Reactions	are chemical changes in which two or more elements/compounds combine to form a more complex product (a compound)
Acid Base Reactions	are redox reactions in which a combustible material combines with an oxidizer to form oxidized products and generate heat (exothermic reaction)
Synthesis Reactions	is a process in which the reactants (the starting materials) have different physical and chemical properties from the products (the newly formed substances)
Combustion Reactions	involve the reaction between an acid and a base, which combine to give salt and water

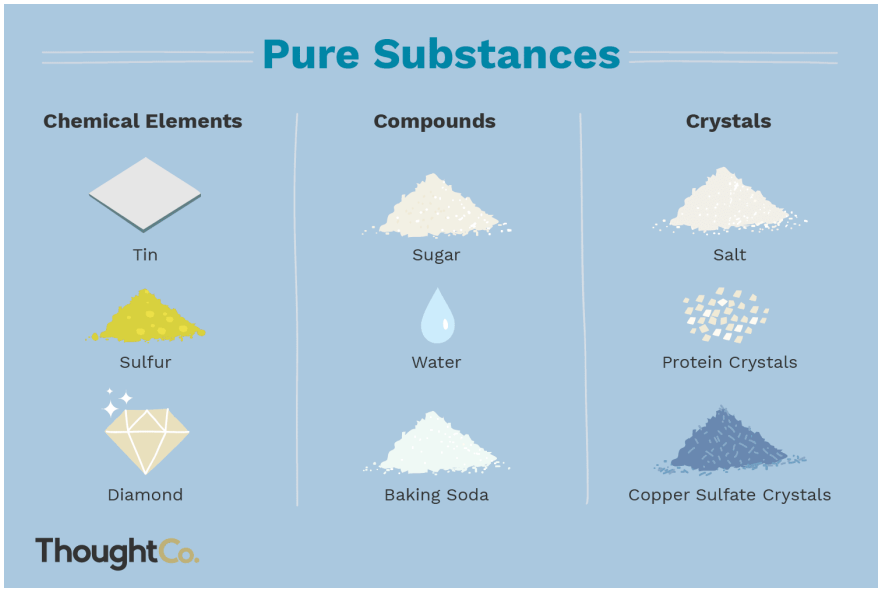
ACTIVE VOCABULARY:

English	Uzbek	Russian
Chemical reaction	Kimyoviy reaksiya	Химическая реаукция
Precipitation reaction	Cho‘kindi ayrilish reaktsiyasi	Реакция осаждения
Acid base reaction	Asosida kislotali bo‘lgan reaktsiyasi	Реакция на основе окисления
Synthesis reactions	Sintez reaksiyalari	Реакция синтеза

Combustion reactions	Yonish reaksiyalari	Реакция горения
Double-replacement reaction	Ikki marta almashtirish reaktsiyasi	Реакция двойного замещения
Activation energy	Faollashtirish energiyasi	Энергия активации
Change	O'zgartirish	Изменять
Consumed	Iste'mol qilingan	Потребленный
Extinguished	Bekor qilingan	Погашенный
Generate	Yaratish	Генерировать
Handling	Ishlov	Обработка
Jointly	Birga	Совместно
Manifest	Manifest	Манифест
Observing	Kuzatish	Наблюдать
Preserved	Saqlangan	Сохранённый
Produced	Chiqarilgan	Произведенный
Symbolised	Ramzlangan	Символизирующий
Represented	Taqdim etilgan	Представленный

UNIT 8

TEXT



In science, a pure substance contains only one element or compound. Impure materials may be mixtures of elements, mixtures of compounds, or mixtures of elements and compounds.

Elements – consist of only one type of atom; – can exist as either atoms or molecules; – cannot be broken down into a simpler type of matter by either physical or chemical means.

Compounds – consist of atoms of two or more different elements chemically joined together; – always contain the same ratio of their component atoms; – have fixed properties that are different from their component elements as a new substance is formed when the constituents are chemically combined; – can only be separated into their elements by chemical means.

Mixtures – consist of two or more different elements and/or compounds joined together physically, not chemically; – have constituents which are present in varying ratios; – do not have fixed properties; – form no new substance and each substance in the mixture keeps its own properties; – can be separated into their constituent parts by physical means. Mixtures are absolutely everywhere. They may be made by

dissolution of a solute in a solvent, or by diffusion, in which particles of different substances mix together. There are different types of mixtures.

Homogeneous Mixtures – in which the two or more substances that form the mixture are evenly distributed throughout the mixture.

Solutions are a special type of homogeneous mixtures in which one substance (the solute) is evenly spread out and thoroughly mixed in another substance (the solvent). They are the best mixed of all mixtures.

Alloys are usually homogeneous mixtures in which the main element (or elements) are metal(s).

Amalgams are special types of alloys that combine mercury and other metals.

Heterogeneous Mixtures – in which the two or more substances that form the mixture are not evenly distributed throughout the mixture.

Suspensions are heterogeneous fluid mixtures containing solid particles large enough for sedimentation. The solid particles may be separated from the liquid by leaving it to stand or by filtration.

Colloids are heterogeneous mixtures in which one substance is microscopically dispersed evenly throughout another substance.

Emulsions are special colloids which have a mixture of oils and waters. Some mixtures that appear homogeneous at first glance are heterogeneous upon closer inspection. Examples include blood and sand.

QUESTIONS:

1. What are elements?
2. What do the elements consist of?
3. What are mixtures?
4. What do the mixtures consist of?

EXERCISES:

1. Try to unscramble these words used in Chemistry.

1. TOAM .....
2. IDLSO .....
3. IIUDQL .....
4. SGA .....
5. DAIC .....
6. ASEB .....
7. LMUOCELE .....
8. ELNTMEE .....
9. CUOPOMDN .....
10. IECSMHT .....

2. Which of the containers listed below would you use to hold liquids, solids and gases? Tick the appropriate column(s).

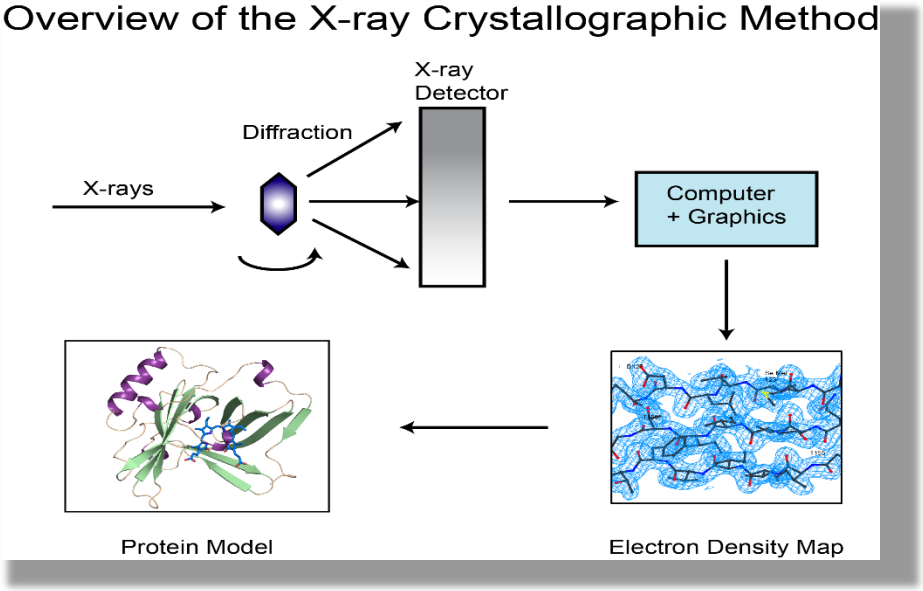
CONTAINER	SOLIDS	LIQUIDS	GASES
barrel			
bomb			
bottle			
box			
bucket			
can			
carton			
cylinder			
drum			
packet			
tin			

ACTIVE VOCABULARY:

English	Uzbek	Russian
Container	Idish	Контейнер
Solids	Qattiq jismlar	Твердые тела
Liquids	Jidkosti	Жидкости
Gas	Gaz	Газ
Tin	Banka	Банка
Barrel	Bochka	Бочка
Bomb	Balon	Баллон
Bottle	Shisha	Бутылка
Box	Quti	Коробка
Bucket	Paqir	Ведро
Carton	Karton quti	Картонная коробка
Cylinder	Silindr	Цилиндр
Drum	Baraban	Барабан
Packet	Paket	Пакет

UNIT 9

TEXT



Analytical methods rely on scrupulous attention to cleanliness, sample preparation, precision and accuracy. They are divided into classical, or wet, methods and instrumental methods, which are currently preferred because they are more sensitive and specific.

Qualitative analysis wet methods include numerous chemical tests and flame tests. The flame test is a quick method of identifying an element by the colour of light it yields in a flame.

Quantitative analysis wet methods – which measure weight or volume – are mainly gravimetric and titrimetric procedures.

Gravimetric analysis involves determining the amount of material present by weighing the sample before and/or after some transformation.

Titration is a procedure used to find the concentration of an acid or alkali using a neutralisation reaction.

Instrumental analysis is a field of analytical chemistry that investigates analytes using scientific instruments.

Spectroscopy measures the interactions of the molecules with electromagnetic radiation. Mass spectrometry calculates mass-to-charge ratio of molecules using electric and magnetic fields.

Crystallography is a technique that characterizes the chemical structure of materials at the atomic level by analysing the diffraction patterns of electromagnetic radiation. X-rays are most commonly used.

Electroanalytical methods measure the electric potential in volts and/or the electric current in amps in an electrochemical cell containing the analyte.

Calorimetry and thermogravimetric analysis determine the interaction of a material and heat.

Chromatography and electrophoresis are separation processes used to decrease the complexity of material mixtures. Four important types of chromatography are: gel permeation chromatography, in which large molecules separate according to their size; ion exchange chromatography, in which charged constituents are separated; gas chromatography, which separates the volatile constituents of a sample; and liquid-liquid chromatography, which separates small, neutral molecules in solution.

Electrophoresis is the movement of electrically charged particles in a fluid under the influence of an electric field. Particles with a positive charge go to the cathode and particles with a negative charge go to the anode.

Combinations of the above techniques produce hybrid or hyphenated techniques, among which are: GC-MS (Gas Chromatography-Mass Spectrometry), LC-MS (Liquid Chromatography-Mass Spectrometry), GC-IR (Gas Chromatography-Infra Red Spectroscopy), LC-NMR (Liquid Chromatography-Nuclear Magnetic Resonance), CE-MS (Capillary Electrophoresis-Mass Spectrometry), ICP-MS (Inductively Coupled Plasma-Mass Spectrometry).

QUESTIONS:

1.What is quantitative analysis wet method?

2.What is qualitative analysis?

3. Four important types of chromatography are:

4.What is crystallography?

EXERCISES:

1. Use a/an/the or no article to complete the sentences.

a..... organic chemistry is ..... study of ..... chemistry of..... life.

b..... analytical chemistry is one of ..... branches of..... chemistry.

c..... wide range of techniques is used to separate ..... chemical compounds.

d..... cellulose composes ..... cell walls of ..... plants.

e..... lipids are insoluble in.....water.

f..... carbohydrates are produced in ..... green plants by ..... photosynthesis.

g..... bacteria are important agents in..... cycles of matter.

h..... fungi include ..... moulds and..... yeasts.

2. Complete the sentences using one of these verbs: *feel – hear – listen – look – see – smell – taste* - touch – watch

a. .... at the blackboard, please!

b. I can't ... anything, speak louder, please!

c. Can you ... the bacterium through the microscope?

d. Don't ... the flask, it's hot!

e. I ... my teacher conducting experiments with great attention.

f. Hydrogen sulphide ... like rotten eggs

g. Never ... anything in the chemistry lab, it may be very dangerous!

h. Bases ... slippery.

i. ... carefully to what I’m saying!

ACTIVE VOCABULARY:

English	Uzbek	Russian
Gravimetric analysis	Gravimetrik tahlil	Гравиметрический анализ
Quantitative analysis	Miqdoriy tahlil	Количественный анализ
Qualitative analysis	Sifatli tahlil	Качественный анализ
Electromagnetic radiation	Elektromagnit nurlanish	Электромагнитное излучение
Chromatography	Kromatografiya	Хроматография
Crystallography	Kristalografiya	Кристаллография
Spectroscopy	Spektroskopiya	Спектроскопия

UNIT 10

TEXT

When we talk about the toxins in our home, the usual suspects include the chemicals in our foods, cosmetics and personal care products. That's why when attempting to embrace a safe, eco-friendly lifestyle, one of the first changes most of us make is shifting to naturally-grown food and non-toxic cosmetics. But, many of the toxins in our home lurk in the very products that claim to protect us – like detergents. It is difficult to think of these products as harmful. After all, we have been using them every day for years; they haven't left any visible signs of damage, and, if they were really that dangerous, they wouldn't be used by so many people. However, the truth is that although detergents leave your clothes smelling like a summer breeze, they often contain a mix of harmful chemicals that have negative side effects on our health. Not to mention that they damage our clothes and leave them faded and worn out. What's more, every time we wash our clothes, these chemicals wash into our sewers and pollute our waterways. Our skin is the largest organ in our bodies, and the chemicals in our clothing and sheets are absorbed into the body through its pores all day. Chemicals in laundry detergents are linked to a range of adverse health impacts – from benign rashes to more serious ailments including cancer as well as birth and developmental defects. Let's take a look at some of the harmful contents of our detergents:

1,4-Dioxane. Identified as a human carcinogen, 1,4-dioxane is a common ingredient in detergents and shampoos. It is used as a solvent and degreaser. Experimental studies on rats and other lab animals have shown that exposure to dioxane can cause benign and malignant tumours in different parts of the body – from the mouth to the liver. In humans, contact with residues contained in detergents results in exposure. 1,4- dioxane is easily absorbed through the skin and by inhalation. It also leaches readily into the soil and groundwater, contaminating the municipal drinking water supply, and increasing the risk of exposure by ingestion.

Sodium Laureth Sulphate (SLS) is a foaming agent used to make detergents, soaps and shampoos froth. SLS can be derived from petroleum and coconut or palm oil. Essentially, it makes detergents effective by allowing water and oil – two immiscible substances – emulsify and be easily lifted off dirty clothes. SLS is widely used because it is inexpensive and effective. SLS is known to irritate human skin and is often implicated in conditions such as eczema, rosacea and psoriasis. It is best avoided by those with sensitive, allergy-prone skin.

Bleach. Often hiding under the label term Sodium Hypochlorite or the catch-all term 'optical brighteners', bleach in detergents is meant to make clothes, especially white ones, appear whiter by converting UV light to visible light. When it comes in contact with the skin, bleach can cause allergic reactions. It is an eye and lung irritant and is toxic to marine organisms.

Formaldehyde is a low-cost preservative and antibacterial agent commonly used in detergents and dishwashing liquids. It is a known irritating agent to the respiratory system, eyes and lungs. Regular contact with formaldehyde can cause allergic reactions such as eczema and contact dermatitis. Daily contact with formaldehyde is toxic to humans and has been linked with cancer. Check your detergent label for mention of this ingredient or look up the manufacturer's website for more information.

Phosphates make detergents more effective by reducing the action of calcium and magnesium and making water less hard. The most commonly used phosphate in

detergents is sodium tripolyphosphate. Despite their effectiveness, phosphates have been banned in several American states and European countries because of their adverse impact on water bodies. Phosphates lead to the buildup of algal blooms in lakes and rivers, which deprives marine organisms of oxygen supply, thus killing them. An eco-friendly laundry detergent is one that is phosphate-free and does not degrade natural eco-systems.

Nonylphenol Ethoxylate. A notorious chemical that is a known endocrine disruptor in humans and animals, nonylphenol ethoxylated is banned in several European countries, but not in India. The UN Environment Programme (UNEP) identified it as a chemical of global concern in its region-based Assessment of Persistent Toxic Substances. It disrupts endocrine function by mimicking estrogen, so that, with repeated exposure, our bodies won't be able to tell the difference between estrogen and nonylphenol ethoxylate. The chemical is not biodegradable and remains in the soil, groundwater and surface water bodies for several years where it is highly toxic to marine organisms.

Benzene. The most commonly used benzene-based surfactants in laundry detergents are alkylbenzene sulphonates (ABS) and linear alkylbenzene sulphonates (LAS). Surfactants lower the surface tension between the liquid and the stains on clothing, suspend the dirt particles in the water and make them easier to dissolve and wash off. Indoor air has high levels of benzene, emitted by household products such as detergents, paint and furniture polish. It irritates the skin, nose and eyes, and is toxic to aquatic life.

Synthetic fragrances. The fragrances in laundry detergents are a mixture of about 4,000 chemicals, many of which are petroleum derivatives. We smell them because they vaporise into the air where they release harmful Volatile Organic Compounds (VOCs) such as terpenes which pollute indoor air. Harsh artificial fragrances are known to irritate the respiratory system and cause problems such as asthma. Opt for a detergent that is fragrance-free or contains a mild aroma. The Better Home laundry detergent contains natural surfactants that are gentle on your

clothes, safe on your skin and pollution-free for water bodies. Subscribe and save up to 35% today.

QUESTIONS:

1. What is Sodium Laureth Sulphate (SLS)?
2. What is Formaldehyde?
3. What is Phosphates?
4. What products contain SLS?

EXERCISES:

1. Choose the suitable subject to complete the phrases below. *Chemical elements • Each phase of matter • Gases • Heating or cooling • Liquids • Matter • Natural plasmas • Solids • The phases of matter*

1. ..... is everything that you can touch, see, feel or smell.

2. ..... make up all matter.

3. ..... has its own chemical and physical properties.

4. ..... are solids, liquids, gases, and plasmas.

5. ..... have a definite shape and volume. They maintain their shape.

6. ..... have a definite volume, but no defined shape. They take the shape of any container they are in.

7. .... do not have a definite shape or volume.

8. .... are not found very often

2. Use comparative or superlative forms of the adjectives/adverbs in brackets to complete the sentences.

1. Methane is (simple) ..... alkane.

2. Benzene is one of (well) ..... known aromatic hydrocarbons.

3. Cellulose is (common) ..... organic compound on Earth.

4. Carbohydrates are (abundant) ..... biomolecules.

5. Flavour enhancers make food taste (good) .....

6. Nucleic acids are (small) ..... organic chemicals in our body.

7. Micro-organisms are (old) ..... form of life on Earth.

8. Eukaryotic cells are (large) ..... and (complex) ..... than prokaryotic cells.

9. E. coli is (useful) ..... microbe in biotechnology.

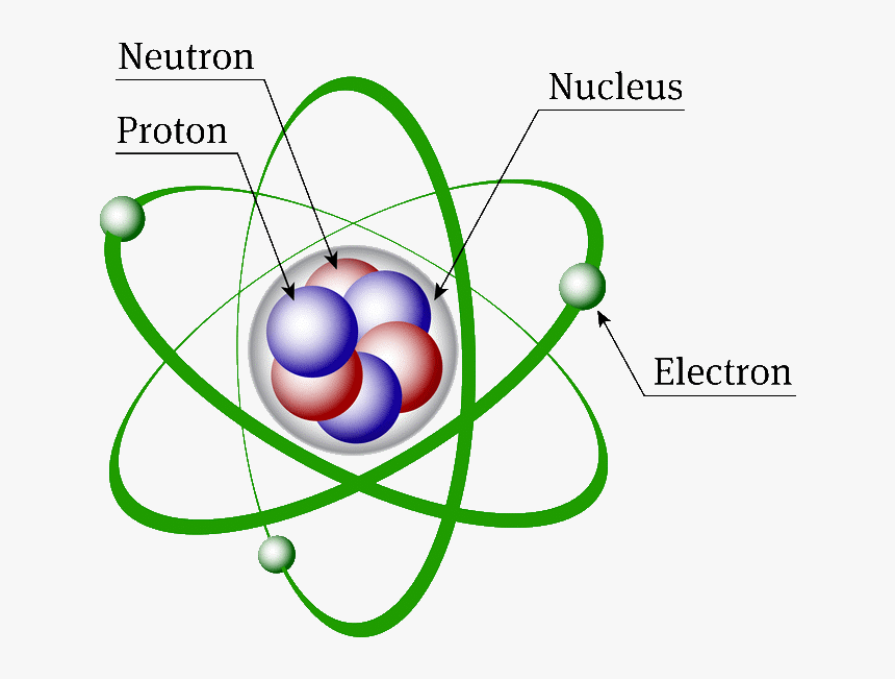
10. The (good) ..... way to prevent pollution is not to throw harmful substances into the environment.

ACTIVE VOCABULARY:

English	**Uzbek**	**Russian**
Toxin	Toksin	Токсин
Sodium Laureth Sulphate	Natriy lauretsulfat	Лаурет сульфат натрия
Bleach	Oqartirgich	Отбеливатель
Formaldehyde	Formaldegid	Формальдегид
Phosphate	Fosfat	Фосфат
Nonylphenol Ethoxylate	Nonilfenolning etoksilat	Этоксилат нонилфенола
Benzene	Benzol	Бензол
Synthetic fragrances	Sintetik hidlar	Синтетические запахи

UNIT 11

TEXT



All matter in the natural world is composed of one or more fundamental substances called elements. An element is a pure substance that cannot be created or broken down by ordinary chemical means. Each element's name can be replaced by a one- or two-letter symbol. An atom is the smallest quantity of an element that retains the unique properties of that element. Atoms are made up of even smaller subatomic particles, three types of which are important: the proton, neutron and electron. Protons and neutrons are made of varieties of a still smaller particle called the quark. Quarks are made up of, and interact with, smaller subatomic particles. An atom does not need to have all three particles, but will always contain at least protons. An atom has an inner core called a nucleus, which is where the protons and neutrons are located. An atom's protons and electrons carry electrical charges. The number of positively charged protons and non-charged (neutral) neutrons gives mass to the atom, and the number of each in the nucleus of the atom determine the element. The number of negatively charged electrons that 'spin' around the nucleus equals the number of protons. Atoms can lose or gain electrons. When they do, they form charged particles called ions. Cations

have fewer electrons and have a positive charge. Anions have extra electrons that create a negative charge. The atomic number, which is the number of protons in the nucleus of the atom, identifies the element and, since an atom usually has the same number of electrons as protons, it identifies the usual number of electrons as well. An element's mass number is the sum of the number of protons and neutrons in its nucleus. Certain elements can exist in two or more different forms. These forms are called allotropes in which the element's atoms are bonded together in a different manner. An isotope is one of the different forms of an element, distinguished from one another by different numbers of neutrons. Isomers are molecules that have the same chemical formula, but a different arrangement of atoms. Two main forces hold atoms together: the electric force, which holds the electrons in orbit around the nucleus, and the nuclear force, which holds the protons and neutrons together within the nucleus. Matter can exist in the form of a pure element, but combinations of elements are more common. A molecule is the smallest particle in a chemical element or compound that has the chemical properties of that element or compound. Molecules are made up of atoms that are held together by chemical bonds. A compound is a substance composed of two or more elements joined by chemical bonds. Generally, compounds are considered a subclass of molecules. A chemical formula is a concise way of showing the elements contained in a molecule/compound and their ratio. The atoms in a compound are chemically joined together by strong forces called chemical bonds. An ionic bond is formed when an electron transfers from one atom to another. A covalent bond is formed when two atoms share one or more electrons.

QUESTIONS:

1. What is an element?
2. What is an isotop?

3. What is an atom made of?

 **EXERCISES:**

1. What am I? Choose from *allotrope • atom • electron • ion • isomer • isotope • molecule • neutron • nucleus • proton*

1. I'm the smallest component of an element having the chemical properties of the element. I'm a/an ....
2. I'm a positively charged subatomic particle. I'm a/an ....
3. I'm a particle in the atomic nucleus and have no electrical charge. I'm a/an ...
4. I'm a negatively charged subatomic particle. I'm a/an ...
5. I'm the centre of the atom, I contain protons and neutrons. I'm a ...
6. I'm an electrically charged atom. I'm a/an ...
7. I'm one of two or more existing forms of an element. I'm a/an ...
8. I'm one of the forms of a chemical element having the same number of protons but different numbers of neutrons in the nucleus. I'm a/an ....
9. I'm a molecule with the same molecular formula as another molecule but with a different chemical structure. I'm a/an ....
10. I'm the smallest particle of a chemical element or compound that has the chemical properties of that element or compound. I'm a/an ....

2. Match the words (A) with the appropriate definition (B)

A	B
Matter is made up of	a combination of two or more atoms from the same or from different elements.
Each element is a pure substance, made up of	a combination of two or more chemically bonded elements.

Atoms contain	a positive charge.
Electrons are	an attraction between atoms that enables the formation of compounds.
Protons have	an electrical charge.
Neutrons do not have	around the outside of the nucleus.
The protons and neutrons are located	different forms of the same chemical element
The electrons orbit	in the nucleus at the centre of the atom.
The number of electrons in an atom is	negatively charged particles.
Allotropes are	one or more of about 100 naturally-occurring elements.
The atomic number of an element is	only one type of atom.
The mass number of an element is	the number of protons its atom contains.
A molecule is	the same as the number of protons, so atoms are electrically neutral overall
A compound is	the total number of protons and neutrons its atom contains.
A chemical bond is	three sub-atomic particles: protons, neutrons, and electrons.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Chemical bond	Kimyoviy aloqa	Химическая связь
Molecule	Molekulyar	Молекулярный
Mass number	Massa soni	Число массы

Allotrope	Allotropiya	Аллотроп
Neutron	Neytron	Нейтрон
Proton	Proton	Протон
Electron	Elektron	Электрон
Negatively charged	Salbiy zaryadlangan	Отрицательно заряженный
Nucleus	Yadro	Ядро

UNIT 12

TEXT

Analytical chemistry is one of the main branches of modern chemistry. It has applications in bioanalysis, clinical analysis, environmental analysis, materials analysis, and forensics. Analytical chemistry is divided into two main areas: qualitative analysis and quantitative analysis. The former involves the determination of unknown constituents of a substance, the latter concerns the determination of the relative amounts of such constituents. Most modern analytical chemistry is quantitative. A simple example of quantitative analysis is the measurement of a

sample's percentage of a given element. Analytical chemists are asked to analyse diverse materials. The determination of the identity or quantity of a constituent of such materials is preceded by a sampling step and by the separation from the sample of either the desired constituent or the undesired, interfering constituents. Another step, preparatory to qualitative and quantitative analyses, is standardization, or calibration, using a pure constituent or a sample containing a known amount of constituent. There is a wide range of techniques available to separate, detect and measure chemical compounds. The oldest methods require the separation of substances in order to measure the weight or volume of a final product. Many modern, sensitive and accurate devices rely on the principles of spectroscopy. By measuring the absorption of light by a solution or gas, we can calculate the amounts of several species, often without the need for separation.

QUESTIONS:

1.What are some of the fields of application of analytical chemistry?
2.What are the two main areas of analytical chemistry?
3.What is qualitative analysis used for?
4.What is quantitative analysis used for?

EXERCISES:

1.Use comparative or superlative forms of the adjectives/adverbs in brackets to complete the sentences.

a. Methane is (simple) alkane.
b. Benzene is one of (well) known aromatic hydrocarbons.
c. Cellulose is (common)organic compound on Earth.

d. Carbohydrates are (abundant) biomolecules.

e. Flavour enhancers make food taste (good).

f. Nucleic acids are (small) organic chemicals in our body.

g. Micro-organisms are (old) form of life on Earth.

h. Eukaryotic cells are (large) and (complex) than prokaryotic cells.

i. E. coli is (useful) microbe in biotechnology.

j. The (good) way to prevent pollution is not to throw harmful substances into the environment.

k. Acid rain is one of (important) environmental problems.

l. Industrial production methods employing enzymes are (safe) and environmentally (friendly) than other methods.

m. Refrigeration and freezing are (popular) forms of food preservation.

n. HACCP id (effective) method of controlling foodborne disease.

o. Laboratory work is (exciting) than class lessons.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Forensics	Sud tibbiyoti	Криминалистика
Application	Ariza	Заявление
Constituents	Tarkibdagi komponentlar	Ингредиенты
Separation	Ajratish	Разделение
Calibration	Kalibrlash	Калибровка
Absorption	Absorbsiya	Абсорбция

UNIT 13

TEXT

Did you know that in the UK every person uses about 150 litres of water every day and most of the water we use is to flush the toilet? Let's take a minute to think about the water we use. The human body is 60% water and we need to drink lots of water to be healthy. When we are thirsty we just go to the kitchen and fill a glass with clean water. We also need water for cooking. Imagine trying to cook pasta or rice without water! We have toilets in our houses and when we want to brush our teeth or have a shower, we use the bathroom. We use water indirectly too. Farmers, who produce the food we eat, use water to make the plants grow. When we turn on a light or switch on a TV or a computer we use energy and we need water to produce this energy. The truth is that we are lucky enough to have clean water whenever we want, but this is not the case for many people around the world. Did you know that around 750 million people do not have clean water to drink? That's around 1 in 10 people in the world. And did you know that 2.5 billion people do not have clean toilets? That's about 1 in 3 people in the world. If we drink dirty water or we can't wash our hands when we go to the toilet, we can catch diseases from the bacteria and become ill. Every year over 500,000 children die from diarrhoea from dirty water. That's around 1,400 children every day! In Ghana, 80% of all diseases are

from dirty water, in Nigeria 70% of people don't have toilets and in Nicaragua, 80% of people don't have clean drinking water. Also, in some countries children walk many kilometres every day to get water and sometimes the water isn't even clean! If children walk many hours a day to get water, they can't go to school so they don't learn how to read or write and don't get an education. In 1993 the United Nations decided that March 22nd is the World Day for Water. On this day every year, countries around the world hold events to educate people about the problems of dirty water and that clean water is something that everyone should have around the world. People organise events to raise money and this money helps countries like Nigeria or Nicaragua get clean water to its people so that children don't die from diarrhoea and so that they can go to school. For World Water Day, some people in the UK walk, run or cycle 10km, others climb mountains or even jump from an aeroplane and skydive to the ground. At one school children between the ages of 10 and 15 walk 6km with 6 litres of water so they can see how it feels to walk a long distance carrying heavy bottles of water. People give them money to do these things and all the money helps get clean water to as many people as possible around the world.

QUESTIONS:

1. What does water mean to you?
2. Why is water important to you?
3. What do you use the most water for?
4. How does water affect the food you eat?

EXERCISES:

1. Fill the gaps with the correct number: ***60%, 1,400, 70%, 10km , 80%, 750, 2.5, 150, 6, 22nd.***

1.In the UK people use about _____ litres of water a day.

2.The human body is _____ water.

3._____ million people around the world do not have clean water.

4._____ billion people around the world do not have clean toilets.

5._____children die from diarrhoea from dirty water every day.

6.In Nigeria _____of people don't have toilets.

7.In Nicaragua _____of people don’t have clean drinking water.

8.The World Day for Water is on March _____ every year.

9.For World Water Day in the UK, people walk, run or cycle _____ to help people who don’t have clean water.

10.In the UK children walk 6km with _____litres of water to raise money for World Water Day.

2. Answer the questions TRUE or FALSE.

1. Water is unnecessary for transportation and recreation.

2. Most of the water on Earth is drinkable.

3. The quantity of water on Earth is the same as it was in the past and will certainly be the same in the future.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Water	Suv	Воды
Human	Inson	Человек
Drinkable	Ichimlik	Питьевой
Transportation	Tashish	Транспортировать
Recreation	Yangilanmoq	Освежение
Clean	Toza	Чистый
Unnecessary	Keraksiz	Ненужный

UNIT 14

TEXT

Questions exist about the challenges that these climate changes pose to biological diversity. Species respond to environmental conditions based on habitat needs and physiological tolerances, which in turn influences community composition, structure, and resilience. There may be shifts in the geographic range of many species, influencing seasonal movement, recruitment, and mortality. Changes in phenology (e.g., timing of resource availability, advances in flowering or nesting dates) may alter predator-prey, competitive interaction, and herbivore-vegetation dynamics. Ecological niches may change at a pace slower than expectations for climate change; similarly, the pace of climate change will likely exceed the dispersal rate of several species. Existing communities may dissociate as species follow the range of suitable conditions, meaning that previously co-occurring species may move in divergent patterns. Recolonization may be limited to areas similar to the range core. Characteristics of species and communities at risk include those with restricted geographic ranges, fragmented distributions, and those that occur at the margins of their range. Other characteristics include limited dispersal ability, low genetic diversity, strong affinity to aquatic habitats, narrow physiological tolerance, and late maturation. Climate change may exacerbate these

risks. For example, amphibians associated with cool, moist conditions may be subject to microclimates beyond their tolerance. Ephemeral streams and ponds may be especially vulnerable to drying with variable precipitation patterns. The small or disjunctive populations that often characterize species of concern are likely to be impacted by stochastic climatic events and may not have the ability to adapt to a changing climate. Climate change has been shown to affect the geographic range of species along elevational gradients. Northern-temperate birds have shifted their ranges to higher latitudes, and tropical birds have shifted their breeding ranges to higher altitudes. These range shifts appear to have affected migration strategies, where success will depend on the rate of climate change relative to essential habitat needs and key community interactions. In the Southwest, small mammals have expanded their ranges upward in elevation while high-elevation species have contracted theirs, leading to changes in community composition. The elevation range shifts of butterfly species recorded in the Sierra Nevada Mountains may continue. There are a number of other changes in biodiversity that are expected to result from climate change. Eastern tree species richness is projected to increase as temperatures warm, with the expansion of oak-hickory complex northward and contraction of aspen-birch habitat. Old-growth forests in the Northwest and high-elevation forests (such as the spruce-fir complex) in the South and elsewhere appear particularly vulnerable. Rising temperatures may influence forest growth due to drought stress and declining soil moisture. This will increase the frequency of pine beetle and other insect attacks; milder winters may encourage the early emergence of other forest pests. Neotropical migratory birds that are sensitive to climate (i.e., climate associates) may change their migratory arrival in spring, as is being currently observed in the West. Water-limited areas (e. g., weather-dependent, ephemeral) and aquatic systems are also expected to be vulnerable to change. Changes in water temperatures may result in reduced oxygen levels in streams and lakes, leading to declines in aquatic species diversity and stress on cold water fisheries. Increased water temperatures in the Caribbean and Pacific Islands may continue to threaten

coral reefs, shellfish, and other species. Barrier islands will be vulnerable to severe storm events, sea level rise, and saltwater intrusion, leading to declines in coastal wetlands and marshes. Communities along the Atlantic Coast and Gulf of Mexico supporting high concentrations of federally-listed species and migratory shorebirds will be especially vulnerable.

QUESTIONS:

1. What is climate change?
2. What do you think about global warming?
3. What should people do to avoid climate disasters?

EXERCISES:

1.Fill in the blanks using the words: *heat weather, water vapor, oceans, pollution, health, fossil fuels,trapped, greenhouse effect*

Human activities from ... to overpopulating are driving up the earth's temperature and fundamentally changing the world around us. The main cause is a phenomenon known as the ... . Gases in the atmosphere, such as ..., carbon dioxide, methane, nitrogen oxide, and chlorofluorocarbons let the sun's light in, but keep some of the ... from escaping like the glass walls of a greenhouse. The more greenhouse gases in the atmosphere, the more heat gets ... , strengthening the greenhouse effect and increasing the earth's temperature. Human activities, like the burning of ... have increased the amount of CO2 in the atmosphere by more than a third since the Industrial Revolution. The rapid increase in the greenhouse gases in the atmosphere has warmed the planet at an alarming rate. While Earth's climate has fluctuated in the past, atmospheric carbon dioxide hasn't reached today's levels in

hundreds of thousands of years. Climate change has consequences for our ..., our ..., our food sources and our... .

2.Match the words (A) with the appropriate definition (B)

word	**definition**
fundamentally	can be reproduced as quickly as produced, clean
phenomenon	rise and fall irregularly in number or amount
Industrial Revolution	to become less in size and importance
alarming	a lung sickness that will not go away
fossil fuels	fog made heavier and darker of smoke and chemical fumes
diminish	changes in manufacturing and transportation when fewer things were being made by hand or moved by human power, but instead by transportation machines or in large scale factories.
smog	basic or essential
asthma	come from old life forms decomposed a long time ago like coal, oil, and natural gas.
renewable	an observable fact or event
fluctuated	causing people to feel worried or frightened

ACTIVE VOCABULARY:

English	**Uzbek**	**Russian**
Fundamentally	Asosiy	В основе
Phenomenon	Hodisa	Феномен

Industrial Revolution	Sanoat inqilobi	Индустриальная революция
Alarming	Bezovta qiluvchi	Тревожный
Fossil fuels	Kazilma yoqilg'i	Ископаемое топливо
Diminish	Kamaytirish	Уменьшить
Smog	Smog	Смог
Asthma	Astma	Астма
Renewable	Qayta tiklanadigan	Возобновляемый
Fluctuated	Ikkilanib turadi	Колеблется

UNIT 15

TEXT

Land can become polluted by household garbage and by industrial waste. In 2014, Americans produced about 258 million tons of solid waste, according to the U.S. Environmental Protection Agency. A little over half of the waste — 136 million tons— was gathered in landfills. Only about 34% was recycled or composted. Organic material was the largest component of the garbage generated, the EPA said. Paper and paperboard

accounted for more than 26%; food was 15% and yard trimmings were 13%. Plastics comprised about 13% of the solid waste, while rubber, leather and textiles made up 9.5% and metals 9%. Wood contributed to 6.2% of the garbage; glass was 4.4% and other miscellaneous materials made up about 3%. Commercial or industrial waste is a significant portion of solid waste. According to the University of Utah, industries use 4 million pounds of materials in order to provide the average American family with needed products for one year. Much of it is classified as non-hazardous, such as construction material (wood, concrete, bricks, glass, etc.) and medical waste (bandages, surgical gloves, surgical instruments, discarded needles, etc.). Hazardous waste is any liquid, solid or sludge waste that contain properties that are dangerous of potentially harmful to human health or the environment. Industries generate hazardous waste from mining, petroleum refining, pesticide manufacturing and other chemical production. Households generate hazardous waste as well, including paints and solvents, motor oil, fluorescent lights, aerosol cans and ammunition.

QUESTIONS:

1. What is land pollution?
2. What do you think land pollution can lead to?
3. In which country is the land most polluted?

EXERCISES:

1. Fill in the blanks with 10 words: *environment – fight – at – species – on – pollution – change – noise – industry – farmland – pollutants - released*

Of all living things, humans have the most impact ... their environment. They ... their habitat to suit their needs, more so than most other .... When a growing population finds there are fewer resources than before, it responds by expanding cities and ..., throwing the natural ... off balance. Many human activities that relate to agriculture, transportation, and .... create different kinds of.... Whether they are .... into the water, the air, or the ground, ... waste no time spreading throughout an ecosystem. The

planet’s health and future depend on the willingness not just of individuals, but governments around the world, to ... the causes of pollution and to work hand in hand to prevent it.

2. Fill in the blanks with words:

1) Into / of / at 2)Healing / breathing / damaging 3) Burn / burned / burning 4) Noisy – fluid – toxic 5) Air – land – water 6) Liar – lawyer – layer 7) Hazard – hazardous – hazards 8) In / to / into 9) Harmful – toxic - acid

Many human activities over the last 200 years have been responsible (1) ---------- polluting the air and (2) ---------- people’s health. Automobile engines and power plants (3) ---------- combustible fuels like gasoline and coal and allow (4) ---------- gases and smoke to escape into the (5) ----------. Some pollutants help destroy the ozone (6) ----------, which is the thin blanket of gases that protects Earth from the Sun’s (7) ---------- ultraviolet rays. Other pollutants contribute (8) ---------- global warming by adding to the planet’s natural greenhouse effect. Still others help to create (9) ---------- rain, a phenomenon that has disastrous effects on lake and forest habitats.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Land	Yer	Земля
Yard trimming	Hovli qirqish	Дворовая отделка
Polution	Ifloslanish	Загрязнение
Leather	Teri	Кожа
Human	Inson	Человек
Garbage	Axlat	Мусор
Solid waste	Qattiq chiqindilar	Твердые отходы

UNIT 16

TEXT

The air we breathe has a very exact chemical composition; 99% of it is made up of nitrogen, oxygen, water vapor and inert gases. Air pollution occurs when things that aren't normally there are added to the air. A common type of air pollution happens when people release particles into the air from burning fuels. This pollution looks like soot, containing millions of tiny particles, floating in the air. Another common type of air pollution is dangerous gases, such as sulfur dioxide, carbon monoxide, nitrogen oxides and chemical vapors. These can take part in further chemical reactions once they are in the atmosphere, creating acid rain and smog. Other sources of air pollution can come from within buildings, such as secondhand smoke. Finally, air pollution can take the form of greenhouse gases, such as carbon dioxide or sulfur dioxide, which are warming the planet through the greenhouse effect. According to the EPA, the greenhouse effect is when gases absorb the infrared radiation that is released from the Earth, preventing the heat from escaping. This is a natural process that keeps our atmosphere warm. If too many gases are introduced into the atmosphere, though, more heat is trapped and this can make the planet artificially warm, according to Columbia University. Air pollution kills more than 2 million people each year, according to a study published in the journal of Environmental Research Letters.

The effects of air pollution on human health can vary widely depending on the pollutant, according to Hugh Sealy, professor and director of the environmental and occupational health track at the Department of Public Health and Preventive Medicine, St. George's University, St. George's, Grenada. If the pollutant is highly toxic, the effects on health can be widespread and severe. For example, the release of methyl isocyanate gas at Union Carbide plant in Bhopal in 1984 killed over 2,000 people, and over 200,000 suffered respiratory problems. An irritant (e.g. particulates less than 10 micrometers) may cause respiratory illnesses, cardiovascular disease and increases in asthma. "The very young, the old and those with vulnerable immune systems are most at risk from air pollution. The air pollutant may be carcinogenic (e.g. some volatile organic compounds) or biologically active (e.g. some viruses) or radioactive (e.g. radon). Other air pollutants like carbon dioxide have an indirect impact on human health through climate change," Sealy told Live Science.

QUESTIONS:

1. What do you think why the air to be polluted?
2. What can air pollution do?
3. How can air pollution be avoided?

EXERCISES:

1. Circle the right option each time.

The planet’s water reserves are constantly polluted by waste from agriculture, industries, and sewers. Since water (was / is / has) always circulating through the environment, it transports the (pollution / polluted / pollutants) it contains from one area to the next. A pesticide that is (sprayed / spread / crowded) on a field, for example, seeps into the groundwater, finds its way to a (stream / streamer / streaming), and finally ends up in the ocean. These toxic (substances / substance /

substantial) harm aquatic plants and animals, and also infect the food chain, causing certain plant and animal species to become (extinct / extinction / exctincted). They can also (breathe / contaminate / effect) humans who eat fish. Even though (dumping / dump / dumped) garbage in the ocean is strictly forbidden, (much / many / little) countries release their untreated sewer waste and dispose of their garbage (out of / in / into) the water. (Because / In addition / While) to this, more than 6 million tons of oil are accidentally (spilled / sprayed / increased) into the ocean every year.

2. Put the bracketed words in the right form or tense.

Every year, millions of tons of industrial waste, household garbage, fertilizer, and pesticides are (dump) ---------- into nature. Many of these (substance) ---------- are not biodegradable, which means that microorganisms in the ground cannot break (they) ---------- down. Things like metal cans and most plastics (accumulation) ---------- in the environment. That is why it is important to (recycle) ---------- and to reuse things instead of (throw) ---------- them out. Most nonbiodegradable (pollute) ---------- in the ground come from industries, which emit thousands substances. Some of (this) ---------- are (high) ---------- toxic chemicals that seep into the ground and (contaminated) ---------- watercourses. In spite of efforts to regulate garbage disposal and farming practices, (country) ---------- around the world are continuing to contaminate more and more of their soil.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Threat	Tahdid	Угроза
To damage	Zarar keltiradi	Наносить ущерб

To pollute	Kir yuvish	Загрязнять
To release	Chiqarish, ajratish	Испускать, выделять
Poisonous chemicals	Zaharli kimyoviy moddalar	Ядовитые химикаты
To suffer from	Azob chekish	Страдать
Car emissions	Egzoz gazlari	Выхлопные газы
Destroy the ozon laye	Ozon qatlamini yo'q qilish	Разрушать озоновый слой
Disease/malady	Kasallik	Болезнь

UNIT 17

TEXT

Chemical industry, complex of processes, operations, and organizations engaged in the manufacture of chemicals and their derivatives. Although the chemical industry may be described simply as the industry that uses chemistry and manufactures chemicals, this definition is not altogether satisfactory because it leaves open the question of what is a chemical. Definitions adopted for statistical economic purposes vary from country to country. Also the Standard International Trade Classification, published by the United

Nations, includes explosives and pyrotechnic products as part of its chemicals section. But the classification does not include the man-made fibres, although the preparation of the raw materials for such fibres is as chemical as any branch of manufacture could be. The scope of the chemical industry is in part shaped by custom rather than by logic. The petroleum industry is usually thought of as separate from the chemical industry, for in the early days of the petroleum industry in the 19th century crude oil was merely subjected to a simple distillation treatment. Modern petroleum industrial processes, however, bring about chemical changes, and some of the products of a modern refinery complex are chemicals by any definition. The term petrochemical is used to describe these chemical operations, but, because they are often carried out at the same plant as the primary distillation, the distinction between petroleum industry and chemical industry is difficult to maintain. Metals in a sense are chemicals because they are produced by chemical means, the ores sometimes requiring chemical methods of dressing before refining; the refining process also involves chemical reactions. Such metals as steel, lead, copper, and zinc are produced in reasonably pure form and are later fabricated into useful shapes. Yet the steel industry, for example, is not considered a part of the chemical industry. In modern metallurgy, such metals as titanium, tantalum, and tungsten are produced by processes involving great chemical skill, yet they are still classified as primary metals.

The boundaries of the chemical industry, then, are somewhat confused. Its main raw materials are the fossil fuels (coal, natural gas, and petroleum), air, water, salt, limestone, sulfur or an equivalent, and some specialized raw materials for special products, such as phosphates and the mineral fluorspar. The chemical industry converts these raw materials into primary, secondary, and tertiary products, a distinction based on the remoteness of the product from the consumer, the primary being remotest. The products are most often end products only as regards the chemical industry itself; a chief characteristic of the chemical industry is that its products nearly always require further processing before reaching the ultimate

consumer. Thus, paradoxically, the chemical industry is its own best customer. An average chemical product is passed from factory to factory several times before it emerges from the chemical industry into the market. There are many routes to the same product and many uses for the same product. The largest use for ethylene glycol, for example, is as an automobile antifreeze, but it is also used as a hydraulic brake fluid. Further processing leads to many derivatives that are used as additives in the textile, pharmaceutical, and cosmetic industries; as emulsifiers in the application of insecticides and fungicides; and as demulsifiers for petroleum. The fundamental chemicals, such as chlorine or sulfuric acid, are used in so many ways as to defy a comprehensive listing. Because of the competitiveness within the chemical industry and among the chemicals, the chemical industry spends large amounts on research, particularly in the highly industrialized countries. The percentage of revenue spent on research varies from one branch to another; companies specializing in large-volume products that have been widely used for many years spend less, whereas competition in the newer fields can be met only by intensive research efforts.

QUESTIONS:

1. What is chemical industry?
2. What types in chemical industry do you know?
3. What do you think is the most popular chemical industry?

EXERCISES:

1.Fill in gaps*: atoms (2) – bases – change – compounds – electrons (2) – elements – formula – inorganic – liquid – matter – metals – metalloids – mixtures –*

molecule – negative – neutrons – no – non-metals (2) – nucleus – organic – oxygen – positive – protons – salts – solutions – suspensions – symbol – water

Chemistry deals with (1) It studies the composition of substances, their action and the chemical changes they undergo. Matter is made up of pure substances called (2), which are identified by a name and represented by a chemical (3) consisting of one or two letters. Elements are divided into (4) – which are good conductors of electricity – (5) – which are poor conductors of electricity and (6). Chemical elements are made up of (7) An atom is the smallest particle into which an element can be subdivided without losing its characteristic properties. The atom, too, is divisible into smaller particles: (8), (9) and (10). The atom is divided into two regions: the (11), or centre, in which the protons and neutrons are located, and a surrounding "orbit" or "cloud" or "shell", in which the (12) move continuously. Protons and electrons carry one unit of (13) and (14) electrical charge respectively, while the neutron carries (15) charge. When two or more atoms are bonded together by electron sharing, they form a (16). Chemical (17) are made up of atoms of different elements combined. Their properties are often different from those of the elements that make them up. In fact, a chemical (18) takes place when atoms of different elements combine to form a molecule. For example, two gases combined may form a (19). Compounds may be (20) or (21) Inorganic compounds are divided into five groups: oxides – which are combinations of (22) with metals; anhydrides – which are combinations of oxygen with (23); acids – which are combinations of an anhydride with (24), (25) which are combinations of oxides with water; and (26) which are combinations of a metal with a non-metal. A chemical (27) represents a molecule of an element or of a compound. It is made up of one or more symbols for the element or elements present in the molecule and subscripts showing the number of (28) of each element present in the molecule. Liquid or solid substances dissolved into other substances form (29). Substances distributed but not

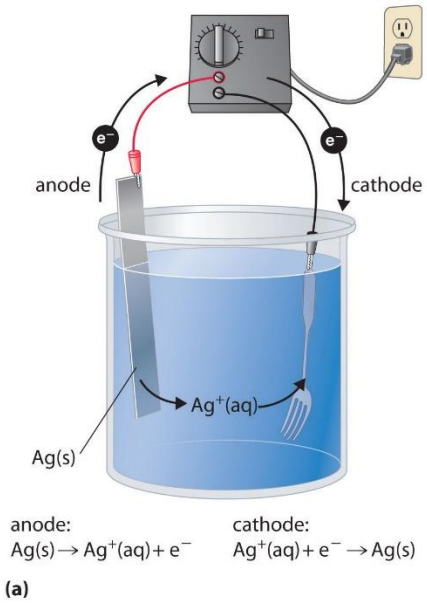
dissolved into other substances form (30). (31) contain different substances which are neither chemically united nor uniformly distributed.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Industry	Sanoat	Промышленность
Explosives	Portlovchi moddalar	Взрывчатые вещества
Man-made fibres	Sun'iy tolalar	Искусственные волокна
Petroleum	Neft	Нефть
Crude oil	Xom neft	Сырая нефть
Petrochemical	Neft-kimyo	Нефтехимический
Metal	Metall	Металл
Metallurgy	Metallurgiya	Металлургия
Natural gas	Tabiiy gaz	Природный газ
Salt	Tuz	Соль
Limestone	Ohaktosh	Известняк
Ethylene glycol	Etilen glikol	Этиленгликоль
Sulfuric acid	Sulfat kislotasi	Серная кислота

UNIT 18

TEXT



Electrolytic process. Later in the 19th century the development of electrical power generation made possible the electrochemical industry. This not clearly identifiable branch of the chemical industry includes a number of applications in which electrolysis, the breaking down of a compound in solution into its elements by means of an electric current, is used to bring about a chemical change. Electrolysis of sodium chloride can lead to chlorine and either sodium hydroxide (if the NaCl was in solution) or metallic sodium (if the NaCl was fused). Sodium hydroxide, an alkali like sodium carbonate, in some cases competes with it for the same applications, and in any case the two are interconvertible by rather simple processes. Sodium chloride can be made into an alkali by either of the two processes, the difference between them being that the ammonia-soda process gives the chlorine in the form of calcium chloride, a compound of small economic value, while the electrolytic processes produce elemental chlorine, which has nearly innumerable uses in the chemical industry, including the manufacture of plastic polyvinyl chloride, the plastic material produced in the largest volume. For this reason, the ammonia-soda process, having displaced the Leblanc process, has found itself being displaced, the older ammonia-

soda plants continuing to operate very efficiently but no new ammonia-soda plants being built.

QUESTIONS:

1. What is an electrolytic process?
2. What is electrochemical industry?
3. What sectors of the electrochemical industry do you know?

EXERCISES:

1. Fill in the gaps with suitable words: *Solvent, depositing, alkali, particle, mercury, dioxide, dyestuff, soluble, charge, equation.*

1) Natural gas is an ... gas that occurs in the earth's crust.
2) ... is a process used to make raw rubber useful.
3) Iron is always present as an ... in commercial aluminium and its alloys.
4) Radioactivity is the ... , exhibited by certain types of matter, of emitting energy spontaneously.
5) A measure of the strength of the electrolyte is its ability ... an electric current.
6) When chemical substances have the same molecular weight but different properties, they are called ....
7) Natural rubber is an elastic substance found as milky dispersion in many species of... .
8) Cellulose is a naturally occurring ....
9) ... is the linking of small molecules (monomers) to make large molecules.
10) ... is a chemical substance which contains plant food.

2. Make up sentences out of these words

1) Enough, analysis, when, is, is, the, sampling, complete, permit, subdivision, small, to.

2) The, main, production, use, energy, fuel, of, of, is, in, atomic, uranium, a, as, the.

3) Dealing, electrolytic, theory, solution, is, a, with, of, in, theory, compounds, dissociation, behavior.

4) Solution, method, metals, is, depositing, from, of, a, electrolysis.

5) Composition, of, depend, only, quantitative, not, their, substances, properties, on, qualitative, and.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Solvent	Hal qiluvchi	Растворитель
Depositing	Saqlash	Депонирование
Alkali	Ishqor	Щелочь
Particle	Zarracha	Частица
Mercury	Simob	Ртуть
Dioxide	Dioksid	Диоксид
Dyestuff	Bo'yoq	Краситель
Soluble	Eriydi	Растворимый
Charge	Zaryad qilish	Заряжать
Equation	Tenglama	Уравнение

UNIT 19

TEXT

Hydrogen is a very widely distributed element. It is found in most of the substances that constitute living matter, and in many inorganic substances. There are more compounds of hydrogen known than of any other element. Free hydrogen, H2, is a colourless, odourless, and tasteless gas. It is the lightest of all gases, its density is about one-fourteenth that of air. Its melting point (–259°C or 14K) and boiling point (–252.7°C) are very low, only those of helium are lower. Liquid hydrogen, with density 0.070 g/cm–3, is the lightest of all liquids. Crystalline hydrogen, with density 0.088 g/cm–3, is also the lightest of all crystalline substances. Hydrogen is very slightly soluble in water; 1 litre of water at 0°C dissolves only 21.5 ml of hydrogen gas under 1-atm pressure. The solubility decreases with increasing temperature, and increases with the increase in the pressure of the gas. In the laboratory, hydrogen is easily made by the reaction of an acid such as sulphuric acid, H2SO4, with a metal such as zinc. Sometimes hydrogen is prepared by the reaction of some metals with water or steam. Sodium and the other alkali metals react very vigorously with water, so vigorously as to generate enough heat to ignite the liberated hydrogen. An alloy of lead and sodium, which reacts less vigorously, is sometimes used for the preparation of hydrogen. Much of the

hydrogen that is used in industry is produced by the reaction of iron with steam. The steam from a boiler is passed over iron filings heated to a temperature of about 600°C. After a mass of iron has been used in this way for some time, it is largely converted into iron oxide, Fe_3O_4. The iron can then be regenerated by passing carbon monoxide, CO, over the heated oxide. There is, of course, nothing special about sodium and iron, except their low cost and availability, that is the reason why they are used for the preparation of hydrogen. Other metals with electronegativity about the same as that of sodium (χ=0.9) react with water as vigorously as sodium, and metals with electronegativity about the same as that of iron (χ=1.8) react with steam in about the same way as iron.

QUESTIONS:

1. What are the physical properties of hydrogen?
2. In what way was hydrogen obtained first?
3. What are the chemical properties of hydrogen?

EXERCISES:

1. Fill in the blanks with prepositions where necessary:

on, by, of, in, with, between, to, out, at, in order to, for

1. The mass … hydrogen is the unit … the measurement … the masses… other elements. 2. The committee set the atomic weight … oxygen …16.000 to make the atomic weights … other elements come … closer … whole numbers. 3. Hydrogen was given the weight … 1.008. 4. Hydrogen was obtained … 1766 … Henry Cavendish … London. 5. Cavendish obtained … hydrogen … dissolving … zinc, iron or tin … diluted H_2SO_4 or HCl. 6. Cavendish was impressed … the lightness … the gas. 7. The name “hydrogen” was given … Lavoisier. 8. Hydrogen exists …

three isotopic forms. 9. There are slight differences … the properties … ordinary water and heavy water. 10. Hydrogen is one … the most abundant elements … the earth. 11. Hydrogen combines … other elements and forms different kinds… compounds. 12. Some … the hydrogen compounds ionize … solution.13. Hydrogen is usually obtained … action … sulphuric acid … zinc.

2. Put the sentences into interrogative and negative forms, give short answers to the obtained questions.

1. There are some students in the room.
2. There are some mistakes in his test-paper.
3. There are some books on the table.
4. There is some information on this process.
5. There is some oxygen in the tube.
6. There are some interesting articles in this journal.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Hydrogen	Vodorod	Водород
Widely distributed	Keng tarqalgan	Широко распространенный
Inorganic	Noorganik	Неорганический
Slightly	Bir oz	Немного
Sulphuric acid	Sulfat kislota	Серная кислота
Converted	Aylantirilgan	Преобразованный
Electronegativity	Elektrmanfiylik	Электроотрицательность

UNIT 20

TEXT

The element selenium usually receives scant*attention in elementary textbooks, probably because it is of little importance commercially. Nevertheless, it is an interesting substance and well worth studying. Selenium was discovered by the Swedish giant among chemists, Berzelius. The element is not abundant, but it is to be found in various ores. Selenium is the sister element of sulphur, forming with tellurium the elements occurring in Group more, we may infer that selenium should be less active than sulphur. Its valences are: +2, +4, and +6, the same as those of sulphur. It can be found in several allotropic forms, just as sulphur does. It will be helpful to remember that the two elements are very much alike in their chemical properties and so the reactions of sulphur are similar to those of selenium. A piece of amorphous selenium is rather hard and quite brittle, just as sulphur is. The dark colour of the element, the silver-grey coating on its surface are characteristic. Another variety of the element is red. The element is both odourless and tasteless. It burns as readily as sulphur does, with a reddish-blue flame and the peculiar odour. In working with selenium, beware of the odour of its hydrogen compound; it is worse than that of hydrogen sulphide. One curious property of selenium should be

mentioned. The substance varies in its electrical conductivity according to the amount of light that falls upon it. We should remember that sulphur is a nonconductor. An experiment shows that selenium differs in this respect. Under proper conditions selenium can form a colloid. One gram of selenium dioxide is dissolved in 500 ml of water. To 50 ml of this solution we add, after heating, 10 ml of a one-percent solution of gelatin, and then, drop by drop, 60 ml of hydrazine hydrate (1:2,000 of water). We must remember to keep it just below the boiling point for 16 minutes. The beautiful peach-pink colour of the colloid is to be observed. The colloid can be made without gelatin, but the protective colloid serves to prolong the life of the colloidal suspension.

QUESTIONS:

1. Where is selenium used in production?
2. What foods are rich in selenium?
3. Does our body need selenium?

EXERCISES:

1. Fill in the blanks with prepositions where necessary: *in, under, of, by*

1.Selenium is … little importance commercially.

2. It was discovered… Berzelius.

3. This element is found … various ores.

4. The valences … selenium are the same as those … sulphur.

5. It can be found … several allotropic forms.

6. It is helpful to remember that selenium and sulphur are very much … alike … their chemical properties.

7. … proper conditions selenium can form a colloid.

2. Fill in the blanks with *few, a few, little, a little.*

1. Only … information is available about iodine pentafluoride as a solvent.
2. … drops of concentrated HNO3 were added to a decomposing melt containing chloride.
3. There is … possibility that such ions can be produced under these conditions.
4. … very interesting reactions have been shown at the lecture.
5. There are … published papers on the preparation and properties of inorganic deuterium compounds.
6. High temperature reactions of polonium have been … studied.
7. There can be… doubt that the term “chemical structure” was used for the first time in 1861 by Butlerov.
8. … of these results have been reported previously.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Selenium	Selen	Селен
Discover	Aniqlash	Обнаруживать
Sulphur	Oltingugurt	Сера
Amorphous	Amorf	Аморфный
Peculiar odour	Maxsus hid	Специфический запах
Nonconductor	Dielektrik	Диэлектрик
Colloidal suspension	Kolloid ishlab chiqarish	Коллоидная суспензия

UNIT 21

TEXT

A few years ago a shortage of natural gas drove prices sky high. Likewise, gasoline prices rose when demands exceeded supplies. A glut in the oil market drove prices back down. The law of supply and demand functioned according to textbook description in case of oil, but the situation is otherwise in the current natural gas market. Natural gas consumers are finding their heating bills more of a burden than last year, in spite of a dramatic increase in supplies. There is so much natural gas available that many suppliers are closing down their plants for lack of a market, and it is rumored that some suppliers are even burning off their surplus gas.

QUESTIONS:

1. Suppliers are burning their surplus gas in order to…
2. What is this text about?
3. What was the result of shortage of gas?

EXERCISES:

1. Match the words (A) with the appropriate definition (B)

A	B
natural gas	1) material that is used for producing heat
fuel	2) a line of connected pipes for carrying oil or gas a long distance;
to store	3) a space measured by the length, by the width and by the depth;
pipeline	4) to make and keep a supply of something for future use;
volume	5) a type of substance like air and usually cannot be seen.

2. Fill in gaps using: *coal, oil, source, gas*

Gas is more difficult to store than … mainly because its volume at normal temperature and pressure is 1,000 times that of oil for the same amount of energy content. In small densely populated countries like the United Kingdom, when ... was the main ... of fuel in the early twentieth century, an infrastructure was built to distribute … from coal throughout the country using a pipeline system from the gas plants to homes in major towns and cities.

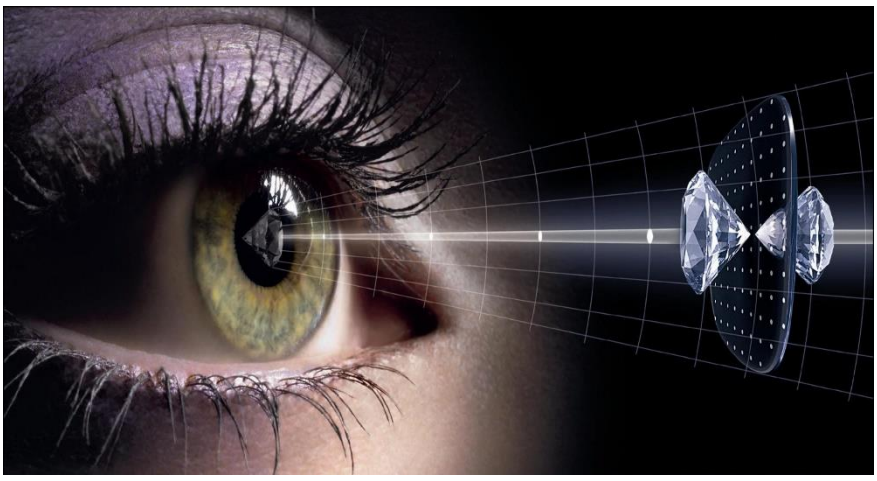
ACTIVE VOCABULARY:

English	Uzbek	Russian
A shortage	yetishmovchilk	дефицит
Natural gas	tabbiy gaz	природный газ
Price	narx	цена
Gasoline	benzin	бензин
Exceed	ko`payish	повышать

Supply	zahira	запас
A glut	zahira	избыток
Oil	neft	нефть
Heating	isitish	отопление
Consumer	istemolchi	потребитель
Lack	kamchilik	недостаток
To burn	yoqmoq	жечь
A bill	hisob	счёт
Market	bozor	рынок
Rumor	g`iybat	молва
Increase	o`sish	повышение

UNIT 22

TEXT 3



All the contact lenses are now made of plastic, but hard and soft varieties are available. The newer and more expensive soft lenses can be bent and will return to their original shape. Made of water-absorbing plastic, they cause very little discomfort and can be worn for as short or as long a period as you like. Lenses of hard plastic do cause discomfort during the adjustment period and must be worn regularly so that

another break-in period isn't necessary. However, vision through soft contacts isn't as good as through hard contacts. Another disadvantage of soft lenses is their tendency to absorb eye secretions and mists from hair spray, room deodorant and the like.

QUESTIONS:

1.What advantage do soft contact lenses have over hard ones?

2.What should a person avoid wearing soft plastic lenses?

3. What all contact lenses are made of?

EXERCISES:

1. Answer the questions.

1. One advantage soft contact lenses have over hard ones is that they

A) are made of natural products

B) are completely flexible

C) correct short-sightedness

D) aren't as expensive

E) come in two varieties

2. We learn from the passage that hard plastic lenses …… .

A) are water absorbent

B) must not be worn too often

C) are initially uncomfortable

D) may break if dropped

E) do not provide clear vision

3. We can conclude from the passage that a person wearing soft plastic lenses ……. .

A) ought to use them for short periods

B) has to get them adjusted by the optician

C) won't have any difficulty seeing clearly

D) should avoid using aerosol sprays

E) doesn't need to have them checked frequently

2. Fill in gaps using: *vision, people, lenses, glasses, optical.*

People choose to wear contact **...** for many reasons. Aesthetics and cosmetics are the main motivating factors for **...** who want to avoid wearing **...** or to change the appearance or color of their eyes. Others wear contact lenses for functional or **...** reasons. When compared with spectacles, contact lenses typically provide better peripheral **...**, and do not collect moisture (from rain, snow, condensation, etc.) or perspiration. This can make them preferable for sports and other outdoor activities.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Lense	linza	линза
Soft	yumshoq	мягкий
Plastic	plastik	пластик
Contact	kontakt	контакт
Expensive	qimmat	дорогой
Shape	shakl	форма
Bend	qayirmoq	сгибать
Absorb	shimmoq	впитывать

Discomfort	noqulaylik	неудобства
Adjustment	moslashish	привыкание
Worn	taqilgan	носить
break-in period	taqish payti	время использования
vision	ko`rish qobilyati	зрение
hard	qattiq	твёрдый
disadvantage	noqulaylik	неудобства
tendency	hussusiyat	свойство
secretion	sekretsiya	секреция
mist	g’ira-shira tuman	пелена
hair spray	soch uchun suyuqlik	лак для волос

UNIT 23

TEXT

Yeast is one of nature’s most perfect foods, since it contains more nutrients than any other food. B vitamins, choline, inesitol, protein, amino acids-yeast has them all. Indisputably, liver and wheat germ are a prime source of protein and B vitamins. But

how many people like the taste of liver or wheat germ? For that matter, yeast has a bitter taste, and not many people enjoy eating it. That's all in the past now. Tasty Mix Yeast Treat, blended with your favorite beverage, tastes so good that children will be clamoring for more. Be creative and add Tasty Mix to your favorite meat or vegetable dish, casserole, bread, soup, practically anything. Easy, convenient Tasty Mix Yeast Treat is one of nature's unique foods. Take advantage of it now. You can find it at any health food store or at your local supermarket.

QUESTIONS:

1. Why do people do not like yeast's taste?
2. What does yeast consist of?
3. Where can one buy it?

EXERCISES:

1. Answer to the questions:

1)This passage implies

(a) there are substitutes equal to yeast in nutrition

(b) yeast tastes better than liver

(c) wheat germ does not have as much as nutrition as liver

(d) this product will give you more nutrients than any other source

2) According to the passage, wheat germ, liver, and ordinary yeast

(a) appeal to most people

(b) contain choline and inositol

(c) taste awful

(d) blend with your favorite drink

3) Tasty MIX Yeast Treat is...

(a) a mixture of tasty yeast in powder form

(b) an old product on the market for years

(c) pleasant tasting mixed with other foods

(d) there are substitutes equal to yeast in nutrition

2.Match the words (A) with the appropriate definition (B)

A	**B**
1) Yeast	a) natural foods without artificial ingredients
2) Vitamins	b) kind of fungus which is used to make breadedients
3) Health food	c) substances that you need in order to remain healthy

ACTIVE VOCABULARY:

English	**Uzbek**	**Russian**
Yeast	achitqi	дрожжи
Contain	o`z ichiga olmoq	содержать
Nutrients	vitaminlar	витамины
Choline	holin	холин
Inesitol	6 atomli spirt	6 атомный спирт
Protein	oqsil	белок
Amino acid	amino-kislota	амино-кислота

Liver	jigar	печень
Wheat germ	bug’doy kurtagi	пшеничный росток
Prime	dastlabki	впервые
Source	manba	запас
Taste	maza	вкус
Blend	aralashtirmoq	перемешивать
Beverage	ichimlik	напитки
Clamor	shovqin	шум
Casserole	sopol idish	керамическая посуда
Health	sog’liq	здоровье

UNIT 24

TEXT

The ancient Egyptians firmly believed in the afterlife and spent their time on the earth preparing for it. Elaborating burial rituals included preparing the burial site, providing for all of the deceased’s material needs (food, clothing, jewels, and tools of their trade) and preserving the corpse so that it would not decay. This

preservation was accomplished through a process of mummification. The ancient left no written accounts as to the execution of this process, so scientists have had to examine mummies and establish their own theories. The embalming process might have taken up to seventy days for the pharaohs and nobility and only a few days the poor. The embalmers spread a variety of compounds of salts, spices, resins in and over the corpse to preserve it. They followed this with a prescribed wrapping, a procedure in which they would strips of fine linen around, over and under the body while placing various amulets within the wrapped linen. Finally, a pharaoh or noble would have been encased in a wooden box before being placed in a sarcophagus.

QUESTIONS:

1.What did the ancient Egyptians believe in?

2.What is this text about?

EXERCISES:

1. Answer to the questions:

1. How have we been able to learn about the mummification process?

a. Accurate records have been handed down to us.

b. Interviews with embalmers who still use the process have revealed the secret.

c. After studying mummies, scientists have developed their own theories.

d. Chemical analysis of the compounds has led us to an explanation of the method used.

Note: Choice (A) is not correct because the passage states that the Egyptians left "no written accounts." Modern embalmers still using these methods (B)are not mentioned at all, nor is chemical analysis (D). sentence 4 does state specifically that

"scientists have had to examine mummies and establish their own theories," choice (C).

2.The word "they" in line 19 refers to…

a. embalmers

b. spices

c. pharaohs

d. the poor

Note: The subject of this paragraph is the "embalmers."

3.The embalming process can best be described as…

a. lengthy and complicated

b. short and simple

c. strict and unfaltering

d. wild and terrifying

4. The word "decay" in line 6 is closest in meaning to…

a. die

b. deteriorate

c. embalm

d. rejuvenate

5. All of the following statements are true except…

a. bodies were preserved as a matter of religious belief

b. all mummification took seventy days to complete

c. special compounds were used to embalm the bodies

6. Why did the ancient Egyptians mummify the deceased?

a. To preserve the body from destruction

b. To scare tomb robbers

c. To encase the body in a sarcophagus

d. To protect the body from harm on the journey to the afterlife

7. It can be inferred that the Egyptians buried food, clothing, jewels, and tools with the deceased because…

a. the family did not want anyone else to share them

b. That was the wish of the deceased

c. they were afraid

d. the deceased would-need them while enroute to afterlife

8. The word "amulets" in line 17 is closest in meaning to…

a. weapons

b. coins

c. charms

d. curse

9. In line 6, "accomplished" is closest in meaning to…

a. performed

b. forsaken

c. reproduced

d. dwindled

10. The distinction between mummification of bodies from different classes is explained in lines…

a. 2-6

b. 10-12

c. 13-14

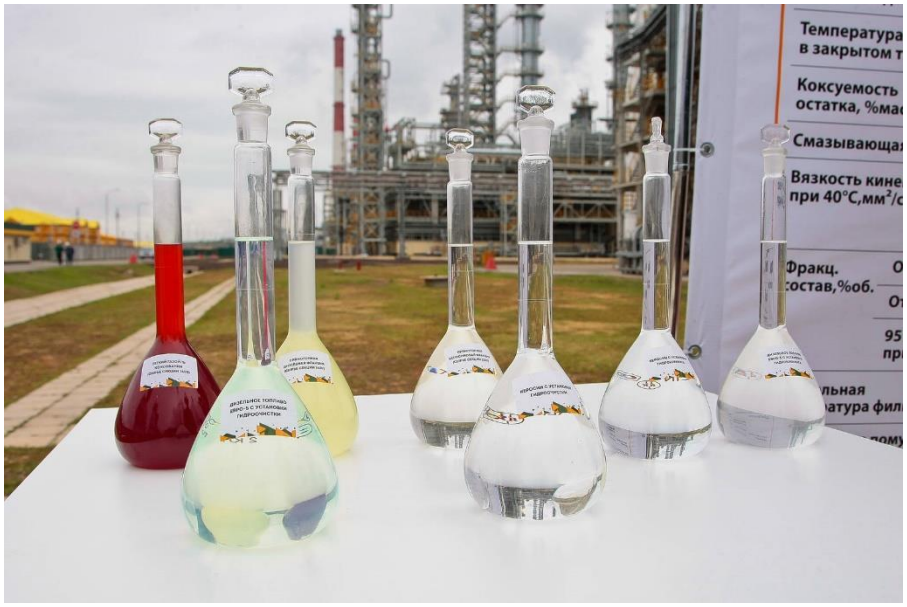
d. 15-17

ACTIVE VOCABULARY:

English	Uzbek	Russian
Ancient	qadimiy	старинный
Afterlife	hayotdan keyin	жизнь после смерти
Earth	yer	Земля
Burial	dafn marosimi	похоронный
Provide	taminlamoq	обеспечивать
Decease	o`lgan	умер
Elaborate	o`ylangan	задуманный
Mummification	mumiyo qilish	мумификация
Corpse	o`lik	труп
Preserve	saqlamoq	хранить
Execution	qatl qilish	казнить
Prescribe	tayinlamoq	назначить
wrap	mato bilan o`ramoq	обвернуть
procedure	rasmiy marosim	официальное мероприятие
strip	yechinmoq	раздеваться
linen	kanop	полотно

UNIT 25

TEXT



Petroleum products, such as gasoline, kerosene, home heating oil, residual fuel oil, and lubricating oils, come from one source-crude oil found below the earth's surface, as well as under large bodies of water, from a few hundred feet below the surface to as deep as 25.000 feet into the earth's interior. Sometimes crude oil is secured by drilling a hole into the earth, but more dry holes are drilled than those producing oil. Either pressure at the source or pumping forces crude oil to the surface. Crude oil wells flow at varying rates, from about ten to thousands of barrels per hour. Petroleum products are always measured in forty-two-gallon barrels. Petroleum products vary greatly in physical appearance: thin, thick, transparent, or opaque, but regardless, their chemical composition is made up of only two elements: carbon and hydrogen, which form compounds called hydrocarbons are few and are classified as impurities. Trace element are also found, but in such minute quantities that they are disregarded. The combination of carbon and hydrogen forms many thousands of compounds which are possible because of the various positions and unions of these two atoms in the hydrocarbon molecule. The various petroleum products are refined by heating crude oil and then condensing the vapors. These products are the so-called light oils, such

as gasoline, kerosene and distillate oil. The residue remaining after the light oils are distilled is known as heavy or residual fuel oil and is used mostly for burning under boilers. Additional complicated refining processes rearrange the chemical structure of the hydrocarbons to produce other products, some of which are used to upgrade and increase the octane rating of various types of gasoline.

QUESTIONS:

1.What are the petroleum products?

2. How are petroleum products always measured?

3. How Petroleum products vary?

EXERCISES:

1.Answer to the questions:

1. Which of the following is not true?

(A) Crude oil is found below land and water.

(B) Crude oil is always found a few hundred feet below the surface.

(C) Pumping and pressure force crude oil to the surface.

(D) A variety of petroleum products is obtained from crude oil.

2. Many thousands of hydrocarbon compounds are possible because

(A) the petroleum products vary greatly in physical appearance

(B) complicated refining processes rearrange the chemical structure

(C) the two atoms in the molecule assume many positions

(D) the pressure needed to force it to the surface causes molecular transformation

3. Which of the following is true?

(A) The various petroleum products are produced by filtration.

(B) Heat

ing and condensation produce the various products.

(C) Chemical separation is used to produce the various products.

(D) Mechanical means such as the centrifuge are used to produce the various products

4. How is crude oil brought to the surface?

(A) expansion of the hydrocarbons

(B) pressure and pumping

(C) vacuum created in the drilling pipe

(D) expansion and contraction of the earth's surface

5. Which of the following is not listed as a light oil?

(A) distillate oil

(B) lubricating oil

(C) gasoline

(D) kerosin

2. Answer to the questions in a written form:

1. Name some petroleum products.

2. In this text, explain the meaning of 'crude'.

3. Who are the largest producers of petroleum in the world?

ACTIVE VOCABULARY:

English	Uzbek	Russian
Petroleum	neft	нефть
Residual	qoldiq	остаток
Crude	dag’al	шершавый
Drill	urg’u/parma	ударение
Opaque	xira	мутный
Impurity	aralashma	смесь
hydrocarbon	gidrakarbon	гидрокарбонат
condense	quyuqlashmoq	загустить
rearrange	rejalashtirmoq	планировать
gasoline	yonilg’i	горючее
disregard	beparvolik qilmoq	безразличие
residue	qoldiq	остаток
barrel	tez harakatlanmoq	быстро действовать

UNIT 26

TEXT

In 1760, a man named Tiphaigne de la Roche made a bizarre prediction. In an imaginary story called Giphantie, mirror images of scenes from nature could be captured permanently on a canvas covered with a sticky material. After the material dried in darkness, the image would remain on the canvas forever.

At the time, the idea was unheard of. It was not until the following century that the concept of photography was born, starting with some experiment by Nicephore Niepce. Nicephore Niepce, who was a French inventor, was interested in lithography, which is a printmaking technique. He learned to burn images onto the plates and then print the images on paper. He shared his findings with Louis Jacques Mande Daguerre, who improved the process and announced it to the French Academy of Sciences in 1839.

The Daguerreotype, the photography method named after Daguerre, met with great success. People called the Daguerreotype a “mirror with memory”. Some portrait artists become Daguerreotypists, now known as photographers.

QUESTIONS:

1.Who was Tiphaigne de la Roche?

2.What does the lithography mean?

3. Who invented photography?

EXERCISES:

1.Answer to the questions:

1. What was the contribution of Daguerre?

(A) He improvised upon the work of Roche.

(B) He introduced the method of photography.

(C) He started the print making technique.

(D) He could print images on canvas.

2. What does lithography deal with?

(A) A print making technique.

(B) Copying of etchings.

(C) Usage of chemicals to make etchings.

(D) Usage of light in printing.

3. When was the concept of photography born?

(A) When an imaginary story called Giphantie was born.

(B) When mirror images of scenes were captured on a canvas.

(C) When Roche made a prediction.

(D) When Nicephore conducted some experiments.

2. Match the words (A) with the appropriate definition (B)

A	B
Bizarre	pictures that are printed from an etched (cut lines into) piece of glass, metal
Lithography	very strange or unusual behaviour.
Etchings	a photograph taken using an early process that used a silver plate and mercury gas.
Daguerreotype	the process of printing from a smooth surface, for eg. a metal plate, that has been specially prepared so that ink may only stick to the design to be printed.

ACTIVE VOCABULARY:

English	**Uzbek**	**Russian**
Bizarre	ajoyib	необыкновенный
Image	ko`rinish	имидж
Permanent	doimiy	постоянный
Sticky	yopishqoq	липучий
Canvas	rasm chizish uchun material	материал для рисования
Forever	abadiy	вечный
Unheard	tinglanmagan	неслышимый
Experiments	tajribalar	опыты
Inventor	kashfiyotchi	изобретатель
Lithography	litografiya	литография

Paper	qog’oz	бумага
Process	jarayon	процесс
Memory	xotira	память
Success	muvofaqiyat	успех
Print	tasvirlamoq	описывать
Technique	uslub	метод
Concept	tushuncha	понятие
Darkness	qorong’ulik	темнота

UNIT 27

TEXT

The Hindenburg was the last in a series of airships designed to carry passengers and cargo over long distances. It could carry fifty passengers in twenty-five luxury cabins with all the comforts of a first class hotel. Cruising at 125 km per hour, it could cross the Atlantic in half the time of the great luxury ocean liners, which it had been built to compete with. But in 1937, The Hindenburg came to an unfortunate end in New Jersey just as it was about to land. In spite of extensive safety precautions, the highly flammable hydrogen with which it was filled burst into flames. Remarkably though, sixty-two of the ninety-seven people on board were able to escape.

QUESTIONS:

1.What was happened to Hidenburg?

2.When did the disaster happen?

3.How many people stayed alive?

EXERCISES:

1. Answer to the questions TRUE or FALSE

1. The Hindenburg was one of the first great airships
2. There were sixty-two people on board at the time of the disaster
3. Ocean liners filled with hydrogen often ended up with explosions
4. After the Hindenburg disaster, there were no more airships of the same type
5. The great airships had a passenger capacity of from twenty-five to fifty passengers

2. Fill in gaps: *Hindenburg, airplane, trips.*

The ... made 10 trips to the United States in 1936. After opening its 1937 season by completing a single round-trip passage to Rio de Janeiro, Brazil, in late March, the Hindenburg departed from Frankfurt, Germany, on the evening of May 3, on the first of 10 round ... between Europe and the United States that were scheduled for its second year of commercial service. American Airlines had contracted with the operators of the Hindenburg to shuttle the passengers from Lakehurst to Newark for connections to ... flights.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Airship	havo kemasi	воздушный корабль
Design	dizayn	дизайн
Cargo	yuk	груз
Passenger	yo’lovchi	пассажир
Luxury	dabdaba	шикарный
Cabin	kayuta	каюта
Cross	nargi tomonga o`tmoq	пересекать
Liner	layner	лайнер
Compete	musobaqalashmoq	соревноваться
Unfortunate	baxtsiz	несчастный
Extensive	ehtiyotkorlik	экстенсивный
Safety	xavfsizlik	безопасность
Precautions	ehtiyot choralari	меры безопасности
Flammable	tez o`t oladigan	легковозгораемый
Hydrogen	vodorod	водород
Fill	to`ldirmoq	заполнять
Burst	portlamoq	взрывать (ся)
Escape	qochmoq	избежать
A board	bord	борд

UNIT 28

TEXT

In an effort to fight the soaring costs of gasoline and public transportation, many athletic students have taken to roller skating. This means of transportation is creating traffic problems and is presenting a safety hazard for skaters as well as motorists in college and university areas through the country. If skaters do not return to the sidewalk, but insist on causing a dilemma for drivers and risking their own safety, the police will issue the violators $15 citations for disregarding a city as well as a state ordinance. In the past month, seven careless students have been injured, three seriously, as they darted into oncoming traffic. Many of them refuse 2to wear helmets and are suffering head injuries as a result. One student was thrown 50 feet and suffered a concussion requiring a three-week hospital stay.

QUESTIONS:

1.What does transportation create?

2. Why will the police issue the violators?

3. Why do people suffer head injures?

EXERCISES:

1. Make 4 sentences using: *hazard, violator, sidewalk, injure.*

2. Fill with prepositions: *on, of, in*

Roller skating is traveling ... surfaces with roller skates. It is a recreational activity, a sport, and a form ... transportation. Roller rinks and skate parks are built for roller skating, though it also takes place on streets, sidewalks, and bike paths. Roller skating originated in the performing arts ... the 18th century. It gained widespread popularity starting … the 1880s. Roller skating was very popular … United States from the 1930s to 1950s, then again in the 1970s when it was associated with disco music and roller discos. During the 1990s, inline outdoor roller skating became popular.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Soaring	o’sib bormoqda	растущий
Creating	yaratish	создавать
Hazard	xavf	опасность
insist on	turub olish	настаивать
ordinance	qonun	закон
violator	tajovuzkor	нарушитель
helmet	dubulg’a	шлем/каска
oncoming	jo‘shqilnik	надвигающийся

disregarding	e’tiborsizlik	игнорирование
require	talab qilmoq	требовать
sidewalk	piyoda	тротуар
injure	shikastlanish	травма

UNIT 29

TEXT

Almost two centuries ago, humans enjoyed their first airborne ride in a cloth balloon. Passengers rode in a basket fastened below the balloon. These brave adventures depended solely on the wind velocity and direction to move hem about because of the lack of a steering mechanism. In 1852, a French clockmaker flew the first controllable balloon a distance of seventeen miles. Germany began producing and using airship about forty-six years later with its famous zeppelins, named in honor of their inventor, Count von Zeppelin. The largest and probably most famous of Germany’s airships was the Hidenberg which could travel at eighty-five miles per hour. Later, the two countries bordering on the English Channel, Great Britain and France, built smaller airships called “blimps”. The latter airships were intended for patrolling the coast

and observing submarine activity, while the former served as passenger and cargo ships.

QUESTIONS:

1.When did the first airborne ride?

2.What was the famous Germany's airship?

3.For what were latter airship intended?

EXERCISES:

1.Match the words (A) with the appropriate definition (B)

A	B
Submarine	a system of parts working together in a machine; a piece of machinery
Zeppelin	a warship with a streamlined hull designed to operate completely submerged in the sea for long periods, equipped with a periscope and typically armed with torpedoes or missiles.
Mechanism	a large German dirigible airship of the early 20th century
Border	a line separating two countries, administrative divisions, or other areas

2. Fill in gaps using *lift floating, invention, experiment, presented.*

Christopher Cockerel's idea was to build a vehicle that would travel just above the surface of land or water ... on a cushion of air. His ... started with two cans, one inside the other, and a hairdryer to blow air into them. The ... showed that air could produce enough pressure to ... a vehicle off the ground. In 1959, in the English Channel, Christopher Cockerel ... the first hovercraft which has been used throughout the world ever since for commercial and military reasons.

ACTIVE VOCABULARY:

English	Uzbek	Russian
Airborne	havo orqali	воздушный
Steering	boshqaruv	рулевой
Border	chegara	граница
Blimp	havo kemasi	дирижабль
Mechanism	mexanizmi	механизм/устройство
Patrol	patrul	патрулировать
Distance	masofa	расстояние
Solely	faqat	исключительно
Zeppelin	dirijabl	Цеппелин (дирижабль)
Submarine	suv osti kemasi	подводная лодка

UNIT 30

TEXT

Of the six outer planets, Mars, commonly called the Red Planet, is the closest to Earth. Mars, 4200 miles in diameter and 55 percent of the size of Earth, 34,600,000 miles from Earth, and 141,000,000 miles from the Sun. It takes planet, along with its two moons, Phobos and Deimos 1.88 years to circle the Sun, compared to 365 days for the Earth. For many years, Mars had been thought of as the planet with the man-made canals, supposedly discovered by an Italian astronomer, Schiaperlli, 1877. With the United State spacecraft Viking I's landing on Mars in 1976, the man-made canal theory was proven to be only a myth. Viking I, after landing on soil of Mars, performed many scientific experiments and took numerous pictures. The pictures showed that the red color of the planet is due to the reddish, rocky Martian soil. No biological life was found, though it had been speculated by many scientists. The Viking also monitored many weather changes including violent dust storms. Some water vapor, polar ice and permafrost (frost below the surface) were found, indicating that at one time there were significant quantities of water on this distant planet. Evidence collected by the spacecraft shows some present volcanic action, though the volcanoes are believed to be dormant, if not extinct.

QUESTIONS:

1. How is Mars called?
2. When did USA spacecraft land on Mars?
3. What were founded on Mars?

EXERCISES:

1. Answer the questions TRUE or FALSE

1. Schiaperlli came from Italy.
2. The word "*monitor*" is nearest in meaning to censored.
3. Man-made canals were supposedly discovered by Schiaperlly.
4. Mars has been nicknamed Deimos.
5. It can be inferred from the passage that the radius of Mars is 34,600,000 miles.

2. Match the words (A) with the appropriate definition (B)

A	B
Speculate	based on or characterized by the methods and principles of science.
Scientific	invest in stocks, property, or other ventures in the hope of gain but with the risk of loss.
Distant	suggest as a desirable or necessary course of action.
Indicate	far away in space or time

ACTIVE VOCABULARY:

English	Uzbek	Russian
Supposedly	g’oyo	предположительно
Scientific	ilmiy	научный
Violent	kuchli	сильный
Compare	solishtirmoq	сравнивать
Rocky	toshloq	каменистый
Speculate	taklif qilmoq	предполагать
Volcanic	vulkanik	вулканический
Permafrost	abadiy muzlik	вечная мерзлота
Indicate	belgilamoq	указывать
Evidence	dalil	свидетельство
Numerous	juda ko’p	многочисленный
Distant	uzoq	отдаленный
Proven	isbotlangan	доказанный

GLOSSARY

A

Absolute Zero: This is the lowest value on any temperature scale. On the Kelvin scale, it is the zero point, and on Celsius scale it is -273.15 degrees. It is the lowest temperature at which the kinetic energy of the atoms and molecules becomes minimum. Absolute temperature can be attained theoretically only. It is not possible to achieve the temperature by any artificial or natural means.

Acid: An acid is a chemical substance which has a tendency to release Hydrogen ions or protons, and accept electrons. In an aqueous state, an acid readily produces a large amount of H+ (aq) ions. Most of the strong acids get ionized almost completely in the dilute aqueous solution, whereas, the ones that are weak acids, ionize partially.

Activated Charcoal: Carbon which is porous, and possess high adsorption power is called activated charcoal. It is useful for removing toxic substances from air, and water.

Activation Energy: During a chemical reaction, the minimum amount of energy which is needed by the reactants to get converted into products is known as activation energy.

Acyl Group: It is a functional group of organic compounds which is usually obtained by replacing the hydroxyl group (–OH) from any carboxylic acid.

Addition Reaction: A type of chemical reaction in which an atom, or a group of atoms is/are added to a double or triple bond compound, in order to change it into a single and double bond compound respectively.

Alcohol: An organic compound which consists of a hydroxyl group (–OH) attached to a Carbon atom of an alkyl group chain.

Aldehyde: A functional group of organic compounds, consisting of one atom each of Carbon, Hydrogen, and Oxygen. Here, the Carbon atom forms a single bond with the Hydrogen atom, and is bonded to the Oxygen atom with the help of a double bond.

Aliphatic: An organic compound in which the Carbon atoms are bonded together in the form of a chain. It does not have aromatic rings.

Alkali Metals: Elements which belong to Group IA of the periodic table.

Alkaline Earth Metals: Elements which belong to Group IIA of the periodic table.

Alkanes: Alkanes are a series of organic compounds, consisting of Carbon and Hydrogen atoms, where all the Carbon atoms are bonded to each other only by single bonds.

Alkenes (Olefins): Unsaturated organic compounds which have at least one carbon-carbon double bond.

Alkynes: A type of unsaturated hydrocarbon compound which has at least one carbon-carbon triple bond.

Allotrope: Two or more elements with the same physical components, but different structural forms. The physical, and chemical properties of allotropic forms of an element are totally different from each other.

Alpha Particle: A positively charged particle with a charge of 2+. It contains two protons, and two neutrons, like the nucleus of a Helium atom.

Alum: It is a white crystalline compound of Aluminum. Hydrated Aluminum potassium sulfate is commonly known as alum. Its chemical formula is $Kal(SO_4)_2.12H_2O$.

Ammonia: Ammonia is an inorganic compound made of Nitrogen, and Hydrogen atoms and is chemically represented by the formula NH_3.

Anion: A negatively charged particle or ion.

Aromatic Hydrocarbons: Aromatic hydrocarbon is a type of hydrocarbon compound, which has at least one structural ring of 6-carbon atoms.

Atom: The smallest structural unit of any chemical element is called an atom.

Atomic Number: The number of protons present in the nucleus of an atom.

Aufbau ('building up') Principle: It is the law that governs electronic configuration in the orbitals of an atom.

Avogadro's Number: Also known as Avogadro's constant. It is the number of particles present in one mole of any substance. It is equal to 6.023×10^23.

B

Back Titration: A technique of analytical chemistry, used to analyze the concentration of a given substance. It is carried out on substances that do not exhibit any valid result in the usual titration method.

Baeyer's Reagent: A chemical agent consisting of cold dilute Potassium permanganate solution. It is used in organic chemistry to detect the existence of unsaturated bonds (double or triple bonds) in a compound.

Balanced Equation: A chemical equation, where the number of atoms and the charge of every element of the reactants, and the products are the same or are in a balanced state.

Balmer Series: Balmer series is used to define a set of spectral lines emitted by the Hydrogen atoms, due to movement of its electrons from one energy level to the another.

Base: A chemical substance that readily donates electrons during formation of a bond.

Beta Particle: Negatively charged particles emitted by the nucleus of radioactive elements.

Bohr atom: The model of an atom formulated by Neils Bohr. He predicted that the negatively charged electrons of the atom revolve around the nucleus of an atom.

Boiling Point: The temperature at which the atmospheric pressure and the vapor pressure of the liquid become equal is called the boiling point.

Boyle's Law: Boyle's law states that at constant temperature the pressure and volume of a given amount of gas is inversely proportional to each other.

Branched Chain Alkane: Those compounds of alkanes that form branches, as a result of bonding the main chain of the molecule with functional groups are called branched chain alkanes.

Brownian motion: The zigzag motion of the tiny particles, suspended in a fluid substance is called Brownian motion.

Buffer Solution: A solution that shows resistance towards change in pH value. Basically, it is either made of a weak acid and a conjugate base, or a weak base and a conjugate acid.

Butanol: An organic compound which consists of four carbon atoms bonded with each other by single bonds and one alcohol or hydroxyl group.

C

Catalyst: A substance which when added to a chemical reaction, increases the rate of the reaction without participating in it.

Catenation: The ability of an element to form a series of covalent bonds with itself and make long chains is known as catenation.

Cathode Ray: Cathode ray can be defined as a flow of electrons released by the negative electrode or cathode in a vacuum tube.

Cation: A positively charged particle.

Chain Reaction: A series of reactions in which the product or by-product of the reaction initiates further reaction.

Charle's Law: Charle's law established a relation between the volume and temperature of gaseous substances. According to the law, at constant pressure the volume of an ideal gas increases with rise in temperature.

Chemical Bonds: A force of attraction that binds two or more atoms together, in order to form a compound is known as a chemical bond.

Chemical Element: Any chemical substance made up of only one type of atom.

Chemical Reaction: The process by which atoms of one or more chemical substances interact with each other, to produce new products with different composition and properties.

Combustion: Combustion is a chemical process in which a reaction takes place between a fuel and an oxidizer and a large amount of heat and light is released.

Covalent Bond: A type of chemical bond in which sharing of electrons takes place between the reacting atoms.

Crystallization: The process which leads to the formation of regular shaped crystals naturally or artificially.

D

D -Transition elements (metals): Elements that have incomplete d-orbitals and belong to the d-block of the periodic table.

D-Orbitals: The third energy level of an atom which can be occupied by electrons. Every d-orbital consists of five set of orbitals.

Dalton's Atomic Theory: Dalton's atomic theory states that elements are made up of very small particles called atoms. It also states that atoms of every element are identical.

Deliquescent: The property of a substance to readily absorb the moisture present in atmosphere and convert into a liquid is known as deliquescent.

Deuterium: Deuterium is an isotope of Hydrogen which is heavier than common hydrogen. This is because, Deuterium has one neutron in its nucleus which is not present in the nucleus of an ordinary Hydrogen.

Displacement Reaction: A type of chemical reaction in which one element of a compound is displaced by another, to form a new compound.

Distillation: The physical process of separation of various components of a mixture of liquids, on the basis of their different boiling points is called distillation.

Donor Atom: A donor atom is the one that shares or donates its electrons to a Lewis acid to form a coordination complex.

Double Bond: A type of covalent bond in which double pairs of electrons are shared between two reacting atoms.

Double Salt: A salt that consists of two or more cations or anions. When in a dissolved state, double salt ionizes to form two different salts but it becomes one substance as it is crystallized.

Dry Cells: An electrochemical cell in which the electrolyte is not in a liquid form but is in the form of a paste with low moisture content.

E

Electrodes: In an electrochemical cell, an electrode can be defined as a surface, on which the transfer of electrons takes place.

Electrolyte: An electrolyte is a chemical substance that splits up into ions in aqueous state or molten state and acts as a medium to conduct electricity.

Electron: Electron is a negatively charged subatomic particle that revolves around the nucleus of an atom.

Electron Affinity: Electron affinity of an atomic or molecular particle is the energy change that takes place as a result of addition or deletion of an electron from a neutrally charged atom or molecule.

Electron Configuration: The arrangement of electrons in the orbitals of an atom is known as electron configuration.

Electronegativity: In a covalent bond between two dissimilar atoms, electronegativity can be defined as the capacity of the atom of an element to draw the valence electrons towards itself.

Emulsion: An emulsion is a mixture of two or more liquid substances where the components are non-miscible with each other.

Endothermic Reaction: A type of chemical reaction which absorbs heat energy during the process.

Enthalpy: Enthalpy is a thermodynamic property of a substance used to quantify the heat content of its any given amount.

Entropy: Entropy is a thermodynamic property, used to measure that energy of a given system which cannot be utilized to carry out any external work.

Exothermic Reaction: A type of chemical reaction that releases heat energy during the process.

F

Fermentation: In biochemistry, fermentation is a process in which large complex organic molecules are broken down into simpler forms, where the enzymes act as catalysts.

First Law of Thermodynamics: According to the first law of thermodynamics, energy can neither be created nor destroyed. It can only be converted from one energy form to another.

Fluorescence: The visible light emitted by a substance, after absorption of light of a different wavelength (mostly longer wavelength than the visible light).

Fossil Fuels: Fossil fuels are exhaustible source of energy, rich in hydrocarbons. They are formed as a result of decomposition of organic matter for millions of years in an anaerobic condition, under high temperature and pressure. Coal, oil, natural gas are examples of fossil fuels.

Fractional Distillation: A distillation process where a liquid mixture whose components have varying boiling points are separated using a fractioning column in the distillation apparatus.

Frasch Process: A technique used for the mining and extraction of Sulfur from its minerals, from the underground deposits.

Free Energy, Gibbs Free Energy: In a thermodynamic system with constant temperature and pressure, free energy or Gibbs free energy is the measure of the total amount of energy that can be utilized for doing useful work.

Free Radical: Those atoms or ions or molecules which have one or more unpaired electrons in them are known as free radicals. Presence of free electrons in a radical makes it highly reactive.

Freezing Point Depression: The phenomenon that causes lowering of freezing point of a liquid solvent substance, on addition of another compound into it is known as freezing point depression.

Fuel Cells: Fuel cells are devices that can produce electrical energy by converting the chemical energy of any particular fuel.

Functional Group: In the molecule of an organic compound, a certain set of atoms characterize the chemical properties of the organic molecule. These groups of atoms are known as functional groups.

G

Galvanized Steel: The steel whose surface has been coated with a layer of zinc in order to prevent corrosion is known as galvanized steel.

Gamma Ray: Gamma rays are a type of electromagnetic radiation with high energy and penetrating power and are released by atoms of radioactive elements. As it has a high penetrating power, gamma rays are used for radiation therapy to treat cancer.

Gangue: The impurities that come with the minerals of an ore, during its mining are known as gangue.

Geiger-Müller counter: Geiger-Müller counter is a special device used for detection of various ionizing radiations like beta particles, gamma rays etc.

Gel: Gel is a jelly like substance where a solid is suspended in a liquid dispersion medium.

Geometrical Isomers: Compounds with the same number of atoms and functional groups, but different geometric structures are called geometric isomers.

Graham's Law: Graham's law establishes the relationship between molecular effusion of a gaseous substance and its molecular weight. It states that the rate of effusion of any particular gas is inversely proportional to the square root of molecular weight of the gas.

Graphite: An allotropic form of element carbon, Graphite, is a good conductor of electricity and possess good lubricating properties.

Ground State: The state in which an atom or molecule or ion has the lowest energy, is termed as ground state. It signifies a stabilized form of that particle.

Group (Periodic Table): In the periodic table, the vertical columns in which elements with similar properties are placed are known as groups.

H

Haber Process: This process is used for industrial preparation of ammonia. Here, nitrogen and hydrogen gases are reacted under high temperature and pressure, in presence of an iron catalyst to produce ammonia.

Half-Life Constant: In nuclear chemistry, half life constant can be defined as the time period required for a radioactive element, to reduce to half of its actual number of atoms, due to radioactive decay.

Heat of Formation (Δhf): The amount of heat absorbed or released due to formation of a pure chemical compound, by the reaction of its constituting elements, under constant pressure is known as heat of formation.

Heisenberg Uncertainty Principle: According to Heisenberg uncertainty principle, the momentum as well as the position of an electron in an atom cannot be determined precisely at the same time.

Henry's Law: As per Henry's law, when the temperature remains constant, the solubility of a gas in a liquid substance is directly proportional to the partial pressure exerted by the gas on the surface of the solution.

Hess' Law: The law states that the energy change that takes place during a chemical or physical process, does not depend on the total number of intermediate steps needed for the completion of the process.

Heterogeneous Mixture: A heterogeneous mixture is made by combining two or more substances with different structures or phases.

Homogeneous Mixture: A type of mixture made up of substances that have uniformity in terms of composition and property.

Homologous Series: A series of organic compounds, that can be represented by a general chemical formula. Members of any homologous series have similar chemical properties.

Hund's Rule: Hund's rule is a guiding principle for filling up of p, d and f subshells of an atom. As per the rule, the pairing of electrons in the same sub-shell begins only after all the orbitals are filled by single electrons.

Hybridization of Orbitals: The term hybridization is used to define the merging of one set of atomic orbitals, for the formation of new orbitals.

Hydrocarbons: Hydrocarbons are simple organic compounds that are made up of hydrogen and carbon atoms only.

Hydrogenation: A chemical reaction, where addition of hydrogen takes place to double or triple bonded unsaturated organic compounds, in presence of a catalyst. In this way, the organic compounds get converted into saturated ones.

I

Ideal Gas: An ideal gas is a hypothetical gas that completely follows the ideal gas law.

Ideal Gas Law: The law states that the product of the volume of the gas and its pressure, is proportional to the amount of the gas and its temperature. Ideal gas law evaluates the behavior of various gases by establishing the relation between the variables like pressure, volume and temperature of a gas. In the equation form, it is given by: $pV=nRT$ where p is absolute pressure, V is the volume of the given gas, T stands for absolute temperature, n is the quantity of gas and R is the gas constant.

Ideal Solution: An ideal solution is the one whose enthalpy is zero. In such a solution, the intermolecular forces between the solvent molecules and different components of solutes are the same.

Inert Gas: Any gas that is inert in nature and does not readily react with other chemical elements is known as inert gas.

Inorganic Compound: The class of compound that does not have any carbon hydrogen bonds in them is called inorganic compounds. The origin of an inorganic compound is mineral and not any living organism.

Internal Energy: Internal energy can be defined as the sum of kinetic energy, potential energy and all other forms of energy that exist inside metals or crystals or molecules.

Ion: An atom or a molecule carrying an electric charge is called an ion. It is formed as a result of losing or gaining of electrons.

Ionic Bond: A kind of chemical bond formed as a result of attraction between oppositely charged particles or ions.

Ionization Potential: Also known as ionization potential, it can be defined as the least amount of energy required for the removal of an electron from a gaseous atom or molecule in its ground state.

Isomers: Molecules whose molecular formulas are same but the structural formulas are different are known as isomers.

IUPAC: It stands for International Union of Pure and Applied Chemistry. It is an international organization that is responsible for setting up standards for naming of elements and compounds and also for symbols and physical quantities related to chemistry.

K

K Capture: A decay mode of radioactive isotopes, where a proton of the nucleus is converted into a neutron, by capturing an electron from the K shell of the same atom.

Ketone: An organic compound that consists of a carbonyl (C=O) functional group. The carbon atom of the carbonyl group is also bonded with two alkyl groups or two aryl groups or one alkyl and one aryl group.

Kinetic-Molecular Theory: Also called collision theory. Kinetic molecular theory defines the various properties of different gases like temperature, pressure, volume etc., on the basis of the composition and movements of their molecules.

L

Lattice energy: The amount of energy needed to separate the constituent ions of an ionic solid is called lattice energy.

Law of Chemical Equilibrium: According to the law, in any reversible reaction at equilibrium state, the rate of forward reaction is directly proportional to the rate of reverse reaction.

Law of Combining Volumes (Gay-Lussac's Law): In a chemical reaction, that is taking place under constant pressure and temperature, the ratio of the volumes of the reacting gases and the resultant products is defined in whole numbers.

Law of Conservation of Energy: According to the law of conservation of energy, the total energy present in a closed system will always be constant. It can be summarized as, the energy of a closed system can neither be created nor destroyed.

Law of Conservation of Matter: Law of conservation of matter states that the total mass of a system in a closed state, remains unchanged despite the changes that are taking place within the system.

Law of Definite Proportions (Law of Constant Composition): The law states that in any chemical compound, the mass of the constituent elements is always present in the same proportion.

Law of Multiple Proportions: The law states that when any two elements combine to give two different compounds by similar types of bonds, then the ratio of those elements is of simple whole numbers.

Law of Partial Pressures (Dalton's Law): The law states that the total pressure of a mixture of gases is equal to the summation of the partial pressures of various gaseous components of the mixture.

Le Chatelier's Principle: During a chemical reaction in the equilibrium state, if any change is brought about in the conditions like, change in temperature or pressure or concentration of the reactants, then a shift is observed in the reaction in order to counteract the change and retain the chemical equilibrium.

Lewis Acid: Lewis acid is that substance of a chemical compound which readily accepts lone pair of electrons to complete its octet.

Lewis Base: Lewis base is a substance that has a lone pair of electron which can be donated during bond formation.

Ligand: A ligand is a particle (atom or molecule or ion) which bonds with a central atom for the formation of coordination complex.

Litmus Paper: A narrow strip of paper that acts as acid-base indicator. When dipped into acid solution a blue litmus paper turns red, on the other hand if a red litmus paper is put into a base solution it becomes blue.

M

Magnetic Quantum Number (mc): The magnetic quantum number of an atomic orbital gives an account of its orientation in space.

Mass Number: The number of neutrons and protons present in the nucleus of an atom is added together to give its mass number.

Melting Point: The range of temperature at which any given solid substance gets converted into liquid state is called melting point.

Metals: Those substances whose atoms are ready to lose electrons and form cations are known as metals. Physically, they are characterized as lustrous and malleable substances with good heat and electrical conductivity.

Metalloids: Those elements in the periodic table, that exhibit intermediate properties of both metals as well as non-metals are known as metalloids.

Mixture: A substance formed as a result of physical combination of two or more substances. In a mixture, each component can maintain its individual identity.

Moderator: In a nuclear reactor, a moderator is an intervening substance that helps in bringng down the speed of fast-moving neutrons during nuclear fission.

Molality: Molality is a unit of concentration used to measure the concentration of a solute in one kilogram of solvent substance.

Molarity: Molarity of a solution can be described as the measure of the quantity of solute substance, present in one liter of the given solvent.

Mole: A basic unit used to quantify the amount of a chemical substance. In other words, it is the number of molecules present in one-gram molecular weight of any given substance.

Molecule: A small, neutrally charged particle formed as a result of chemical bonding between two or more atoms.

N

Natural Gas: A gas with high methane content, found along with various fossil fuels and is used as a fuel.

Neon: A noble gas element found rarely on the surface of the Earth but is abundantly found in the Universe.

Neutralization: A chemical reaction that takes place between an acidic and basic substance and leads to the formation of salt and water, is called neutralization.

Neutrino: A high-speed, neutrally charged, tiny particle with negligible mass, formed because of some radioactive decay.

Neutron: A sub atomic particle with no electrical charge, present in the nucleus of an atom.

Noble Gases (Rare Gases): Those elements that belong to the group 18 of the periodic table are called noble gases. They are – helium, neon, argon, krypton etc. All of them are found in the form of monatomic gases and are chemically less reactive.

Nonmetals: A class of chemical elements that do not have the characteristics of metallic substances.

Nonpolar Bond: A type of covalent bond where the electrical charge is evenly distributed.

Nuclear Energy: The energy generated as a result of splitting or fusion of the nuclei is known as nuclear energy.

Nuclear Fission: A type of nuclear reaction where the nucleus of a heavy element is split up to form lighter nuclei, and a large number of free electrons and gamma rays are released in the process.

Nuclear Fusion: A type of nuclear reaction where nuclei of two atoms that are light in weight, combine together to form a heavier nucleus, resulting in release of high amount of energy.

Nuclear Reaction: The phenomenon that brings about alteration in the nucleus of an atom and is accompanied by energy-change in large-scale is called nuclear reaction.

Nucleons: Those particles that constitute the nucleus of an atom. In other words, protons and neutrons are collectively known as nucleons.

Nucleus: The densest part of an atom located at its center which contains protons and neutrons is called nucleus.

O

Octet Rule: According to octet rule, during the formation of a chemical bond, the atoms of the combining elements tend to attain eight electrons in their outermost orbit.

Olefin Fiber: A large chain of hydrocarbon compounds prepared by polymerization of alkenes. It is used in the manufacture of clothing, textiles etc.

Orbital: An orbital is a specific part within an atom where a pair of electrons with opposite spins are present.

Organic Compound: A class of chemical compounds that consists of hydrocarbons.

Osmosis: The process by which the solvent molecules of a solution, move from a higher concentration region to a lower concentration region, through a semipermeable membrane is called osmosis.

Ostwald Process: It is a method used for the production of nitric acid industrially, by using ammonia and oxygen.

Oxidation Half Reaction: That half of a redox reaction where loss of electrons takes place. In this half, the oxidation number of the reactant atoms increases.

Oxidation Numbers: Also referred to as oxidation state. It represents numerically, the magnitude of oxidation of any given atom in a compound.

Oxidizing Agent: A chemical substance that undergoes reduction in order to oxidize another reactant, during a chemical reaction is known as oxidizing agent.

P

Partial Pressure: In a mixture of gases, the partial pressure is the pressure exerted by one individual gas, when it occupies the entire volume.

Pauli Exclusion Principle: Pauli exclusion principle states that no two electrons of an atom can have similarity in the values of their four quantum numbers.

Periodic Law: According to the periodic law, as the atomic number of the elements increase, certain behavior tends to repeat systematically after regular intervals.

Periodic Table: In a periodic table, elements are arranged in accordance with their increasing atomic number. It provides us with all required information related to the elements.

Periodic Trend: The tendency of the elements to change certain properties, as we move from one side of the periodic table to another is described as periodic trend.

pH: pH is the scale used to measure the acid or base properties of a given solution.

Photochemistry: The study based upon the chemical reactions that occur with the help of light is known as photochemistry.

Photon: A primary particle that forms the basic unit of various forms of electromagnetic radiations, including light. It shows dual properties of both a wave as well as a particle.

Physical Property: That aspect of any substance which can be evaluated without bringing any change to its chemical structure is known as physical property.

Planck's Constant: Planck constant is a proportionality constant that is used to express the relationship between the energy and frequency of an electromagnetic radiation.

Polar Bond: A type of covalent bond where there is an uneven distribution of charges is called polar bond.

Polymer: A large chain of molecules, formed as a result of repeatability of the basic structural units, where each unit is attached with the other by means of covalent bonds is called a polymer.

Polymerization: The process where the smaller units of molecules are combined to form a large three-dimensional structure of polymer chains is called polymerization.

Positron: A positron is the tiny particle produced and released during radioactive decay. It carries a single positive charge and its mass is equal to that of an electron.

Propane: An organic compound that consists of three carbon atoms which are bonded with each other by single bonds. It is found as a colorless, odorless gas and is highly inflammable in nature.

Q

Quantum Theory: Also called quantum mechanics, it is a theory that deals with the behavior of different objects at the atomic and subatomic level.

Qualitative Analysis: Qualitative analysis is the identification of the components that are present in a particular compound or mixture with unknown composition.

Quantitative Analysis: A form of chemical analysis which helps to ascertain the amount of a particular component present in a given sample.

Quantum Number: Numbers that are used for the quantization of the energy levels of the electrons present in an atom are known as quantum numbers.

R

Radioactive Dating: A method used for calculating the age of various naturally occurring or man-made ancient objects, with the help of the half-life constant of the radioactive element present in them.

Radioactivity: The phenomenon of the disintegration of the nuclei of unstable atoms, that results in loss of energy in the form of different types of radiations like alpha and beta particles, gamma rays etc. is known as radioactivity.

Radioisotope: Radioisotope is an atom that has a highly unstable nucleus which causes radioactive decay and leads to radioactive emissions.

Raoult's Law: The law states that in an ideal solution in the equilibrium state, the total vapor pressure depends on the vapor pressure of every individual component and their mole fractions in the solution.

Rare Earth Elements: A set of elements that are positioned in those two periods (or rows) of periodic table that are detached from its main body.

Rate of Reaction: During a chemical reaction, rate of reaction can be defined as the pace at which the conversion of the reactants into products takes place.

Reactants: In a chemical reaction, those chemical substances that are used up to form the final products are known as reactants.

Reaction Kinetics: Also known as reaction kinetics, it is the study of the rate at which a chemical reaction takes place.

Reagent: A reagent is a chemical which when added during a chemical reaction helps in producing, detecting and measuring other substances.

Redox Reaction: A chemical reaction where both reduction and oxidation processes take place due to exchange of electrons between participating atoms.

Reducing Agent: A chemical substance that oxidizes itself for the reduction of another reactant, in a chemical reaction is known as reducing agent.

Reduction: The chemical process that involves gaining of electrons by an atom or an ion.

Reversible Reaction: The chemical reaction that takes place both in the forward as well as in the backward direction.

Roasting: Roasting is a common chemical process that is used to extract metals from their sulfide ores. It involves, heating of the ore at high temperature in presence of atmospheric oxygen, in order to get rid of the sulfide. This way, the metal is obtained either in a free state or in the form of an oxide.

S

Salt: Salt is a chemical compound obtained by the neutralization of acidic and basic substances. Table salt that we use at home is also produced by the neutralization of acid and base.

Saturated Hydrocarbons: The simplest forms of hydrocarbon compounds, where all the carbon atoms are bonded to each other with the help of single bonds.

Saturated Solution: A solution where the solvent is in a completely saturated state and cannot dissolve additional amount of solute into it.

Second Law of Thermodynamics: The second law of thermodynamics states that in any cyclic process, it is impossible to convert hundred percent of the heat energy into work.

Single Bond: A type of chemical bond that consists of only one shared pair of electrons in between two atoms.

Solute: The substance which is present in a dissolved state in a solution is called solute.

Solvent: In a solution, the substance in which the solute substances can get dissolved is known as solvent.

Stoichiometry: The branch of chemistry that deals with the measurement of the quantities of reactants and products of a chemical reaction is called stoichiometry.

Structural Formula: When the structure of the molecule of a compound is represented in the graphical form, it is called a structural formula.

Structural Isomers: Compounds that have the same set of atoms with same molecular formula, but are arranged in different geometrical patterns are known as structural isomers.

Substitution Reaction: A chemical reaction in which a functional group present in a given chemical compound is substituted by a new group.

T

Ternary Acid: An acidic substance that consists of three different elements. Usually, it contains one hydrogen atom, one oxygen atom and a nonmetal.

Ternary Compound: A chemical compound that is made up of three different elements.

Tetrahedral: Describes the shape of a molecule, where one atom at the center is bonded with four atoms placed in the four vertices of a tetrahedron.

Thermal Cracking: The process by which organic molecules with complex structures are broken down into simpler forms, by heating them in the absence of atmospheric oxygen, under the influence of a catalyst.

Thermodynamic Equilibrium: A system is said to be in a state of thermodynamic equilibrium when the energy gained by it from the surroundings is perfectly balanced with the energy lost to the environment. In other words, in a thermodynamic equilibrium condition, the temperature of a system remains constant.

Third Law of Thermodynamics: The third law of thermodynamics states that at absolute zero temperature, the entropy of an element in a perfect crystalline form would become zero.

Titrant: A titrant is a chemical reagent with known concentration, which is added to the analyte during the process of titration, in order to calculate the concentration of the analyte in the solution.

Titration: It is a common laboratory technique used for the calculation of the concentration of a reactant, in different types of chemical reactions.

Transition State: Transition state theory assumes, that during a chemical reaction, the reactants are first changed into a highly activated transition state and then they get converted into the final products.

Triple Bond: A type of covalent bond where three pairs of electrons are shared between the bonding atoms.

Tritium: An isotope of hydrogen that has an unstable nucleus and hence, exhibits radioactive properties. It has a heavy nucleus that contains two neutrons and one proton.

Tyndall Effect: When a ray of light passes through a colloidal substance, it gets scattered by the tiny, suspended particles of the colloid. This scattering effect of light is called Tyndall effect.

U

Unimolecular Reaction: A type of chemical reaction where only one single molecule is involved. The molecule usually undergoes decomposition or isomerization or rearrangement due to this process.

Unit Cell: A simple arrangement of atoms or molecules which is repeated to develop a solid crystal structure is called a unit cell.

Universal Indicator: It is an indicator that changes its colors through a large range of pH values of the pH chart, for the identification of acidic or basic nature of different solutions.

Unpaired Spin: Unpaired spin is referred to as the single electron that fills up an orbital of an atom. The characteristic of an unpaired spin is that it is highly unstable and tends to react to form a paired electron.

Unsaturated Hydrocarbons: A type of organic compound that consists of one or more number of double or triple bonds between the carbon atoms.

V

Valency: Valency is a chemical property of an element, that defines the highest number of bonds that its atom can form with other univalent atoms like hydrogen, chlorine etc.

Valence Bond Theory: Valence bond theory describes the formation of a bond in a molecule. It states that partially-filled atomic orbitals of different atoms overlap with each other in order to form covalent bonds.

Valence Electrons: Those electrons that are present in the outermost orbit of an atom and participate in the formation of chemical bonds are called valance electrons.

Valence Shell: The outermost electron orbit of an atom is known as valence shell. The electrons of valence shell take part in chemical reactions to form bonds.

Valence Shell Electron Pair Repulsion (VSEPR) Theory: Valence shell electron pair repulsion (VSEPR) theory is a model that deals with the shape that a molecule acquires after the formation of a chemical bond. It states that the atoms in a particular molecule assume a particular shape, in order to keep maximum distance between the electron pairs, so that, the repulsive forces between them can be minimum.

Van der Waals Force: The force of attraction or repulsion that exists between the non-bonded parts of a molecule. For example – the forces between dipole-dipole or induced dipole-induced dipole etc.

Vapor Pressure: The pressure exerted by the vapor of a substance, when at equilibrium with its non-vaporous phases is known as vapor pressure.

Vitrification: The process involved in the conversion of a substance from crystalline form to glass with amorphous structure is known as vitrification.

Voltaic Cells: A kind of electrochemical cell where two different metals are linked and are submerged in a fluid with high electrical conductivity. Voltaic cells generate electricity with the help of chemical reactions.

Vulcanization: A special chemical process, where rubber is treated with sulfur and other chemical substances under high temperature, so that they combine with the rubber to enhance its strength and elasticity is called vulcanization.

W

Water: Water is a colorless, odorless, transparent liquid substance. Its molecule is made up of two hydrogen atoms and one oxygen atom. It acts as an excellent solvent and is often referred to as the universal solvent.

Water Gas: A type of gaseous fuel made up of hydrogen and carbon monoxide. It is a highly combustible substance and requires careful handling.

Water Hardness (or hard water): When water gets contaminated with a high content of cations of various metals, like magnesium, calcium etc. in dissolved state, it is called water hardness. Hard water often forms layers in boilers, water pipes etc. It also reduces the cleaning effect of soaps and detergents.

Water of Crystallization: The water that is found along with solid crystals but is not chemically bonded with any of the ions or molecules of the crystals is known as the water of crystallization.

Water Softener: The chemical substances which when added to water, help in the removal of ions that cause hardness of water are known as water softeners. Sodium carbonate or washing soda is an excellent water softener. These chemicals are used in the water softening systems.

Wax: Wax is a form of lipid substance that is made up of long-chains of a large variety of hydrocarbon compounds. They include alkanes, alcohols, esters, fatty acids etc. Due to the presence of ester in it, wax has a very low melting point.

Weak Acid: A weak acid is the one, which does not get dissociated completely into anions and hydrogen ions in its solution.

Weak Base: A basic substance that gets only partly ionized in an aqueous solution is called a weak base.

Weak Electrolyte: A substance that does not produce sufficient free ions in its solution form, as the ions do not get dissociated completely. As a result, a weak electrolyte in solution form or molten state is not a good conductor of electricity.

Wurtz reaction: It is a reaction where coupling of two molecules of alkyl halides takes place, when they are reacted with sodium and form a new alkane.

X

X-Group: In an organic compound, X group defines the presence of a halogen group in it. It is used to define the structural formula of the compound.

Xenon: A noble gas element whose atomic number is 54. Chemically, it is denoted by Xe. It is a heavy gas and does not have any color and odor of its own.

Y

Yield: It is often termed as reaction yield or chemical yield. The actual quantity of a product that is produced in any chemical reaction is called yield.

Ytterbium: It is a rare earth element that belongs to the lanthanide series of the periodic table. Its atomic number is 70 and is denoted by the chemical symbol Yb.

Yttrium: A transition metal that belongs to Group 3 of the periodic table. Chemically, it is represented with the letter Y. The atomic number of yttrium is 39.

Z

Zaitsev Rule: As per the rule, when a number of alkenes are formed due to dehalogenation, caused by an elimination reaction, the alkene which is more stable in nature will be the major product of the reaction.

Zeolite: A solid, mineral substance with numerous tiny pores on its surface. Due to the pores, it has a high adsorption power and is commercially used as adsorbents.

Zero Order Reaction: A chemical reaction which does not depend on the concentration of the reactants is known as zero order reaction.

Zero Point Energy: The least energy possessed by an atom in its ground state. It can also be defined as the quantity of energy that exists in vacuum.

Zinc: Zinc is a bluish-white, lustrous, metallic substance. It is the first member of the Group 12 of the periodic table. Atomic number of zinc is 30 and it is represented by Zn.

Zirconium: Zirconium is a transition metal with a grayish white color. It shows strong resistance towards corrosion and therefore, is used in various alloys.

Zone Refining: A technique used for the purification of substances, that require high amount purity. For this, a narrow molten zone is moved along the length of the solid,accumulating the impurities in the molten zone which are then carried to the end of the bar.

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