Name of subject	Chemistry (ECTS 4)
Subject/module code	KIM1104
Science taught semester (s).	1st semester
Responsible teacher	Xakberdiyev Shuxrat Maxramovich (PhD), associate professor.
Education language	Uzbek
Study to the program connection	Mandatory
Training hours (this including independent education)	**Total hours-120.** **Audience Training hours - 48.** Lecture training hour –24 Laboratory training hour – 12 Practical training hour – 12 **Independent education -72 hours**
ECTS	4
The purpose and tasks of subject / learning outcomes	**The purpose of teaching the subject** The goal is to develop the student's ability to think chemically, apply chemical laws in modern technology, familiarize themselves with and study the properties of materials and substances used in technology, and develop the skills to apply them in practice. **The task of the subject** to reveal the role and importance of a specialist in his work by forming theoretical knowledge, practical skills, a methodological approach and a scientific worldview necessary for logical observation of the content of chemical phenomena and processes. The purpose of "Green Chemistry" is to develop practical skills in students on the 12th principle of "Green Chemistry", which is to select synthesis methods in the following chemical processes, to achieve that reagents and substances obtained are less harmful to humans and the environment when choosing synthesis methods, to reduce toxicity while maintaining their effectiveness when creating new chemicals, to avoid the use of toxic additional solvents and separating reagents in production, to always try to choose the most selective catalytic processes, and to minimize chemical hazards such as explosions, combustion and leakage of substances used in chemical processes. **Learning outcomes:** As a result of mastering the subject, the student should: • have the skills to connect the theoretical knowledge being studied with practice; • have the ability to know the relationship of the phenomena being studied and to objectively describe them; • know the laws and properties of chemistry and be able to use them; • understand the program materials and have an imagination in the process of preparing for classes on chemical compounds
Course content (topics)	**I. Module 1. Introduction. Basic concepts and laws of chemistry** **Topic 1.** Basic concepts of chemistry. Basic laws of chemistry Introduction. Chemical science and industry in Uzbekistan. Purpose, tasks of chemistry. Basic concepts of chemistry: atom, molecule, gram-atom, gram-molecule, chemical compound, chemical element, chemical formula, chemical reaction, chemical equation. Simple and complex substances. Classes of inorganic compounds. Basic laws of chemistry. Stoichiometric laws: Law of conservation of mass of matter. Law of constancy of composition of matter. Law of equivalents. Law of multiple proportions. Avogadro's law. **Topic 2.** Atomic structure. D.I. Mendeleev's periodic table of elements. Types of chemical bonds Atom is a complex system. Atomic structure. Atomic nuclei. Electron

clouds of an atom. Bohr's postulates. The order and regularity of filling atomic orbitals with electrons. Electronic configuration. Normal and excited states of atoms.

D.I. Mendeleev's periodic table of elements. Dialectical description of the periodic law. Change in the properties of chemical elements. The general significance of the periodic system and the law.

The concept of chemical bonding. The main types of chemical bonding and their interrelationships. Ionization energy. Electron affinity. Electromagnetic affinity of elements. Covalent bonding. Types of covalent bonding. Bond polarity. Ionic bonding. Hydrogen bonding. Coordination bonding. Mechanism of formation of donor-acceptor bonds in complex compounds. Types of crystal lattices. Metallic bonding.

Topic 3. Chemical kinetics and chemical equilibrium. Information about chemical kinetics. Chemical reaction rate and factors affecting it. Homogeneous and heterogeneous reactions. Effect of concentration on reaction rate. Law of mass effect. Rate constant. Van't-Hoff's rule. Catalysts. Catalysis. Homogeneous and heterogeneous catalysis.

Reversible and irreversible reactions. Chemical equilibrium and factors affecting it. Shift of equilibrium. Le Chatel's principle. Equilibrium constant. Importance of chemical kinetics and equilibrium in industry.

Topic 4. Water. Properties and hardness of water. Water in nature. Structure of the water molecule. Phase diagram of water. Physical and chemical properties of water. Water hardness and methods of its removal. Importance of water in human health, national economy and technology.

Topic 5. Solutions. Disperse systems and their description. Classification of disperse systems. Coarsely dispersed systems. Colloidal solutions. Pure solutions. Diluted, concentrated solutions. Saturated, unsaturated and supersaturated solutions. Concentration of solutions. Solutions with percent, molar, normal and molal concentrations. Titer of the solution. Solubility. Use of solutions and their role in technology.

Topic 6. Theory of electrolytic dissociation. Ionic equations. Hydrolysis of salts

Electrolyte and non-electrolyte solutions. Aqueous solutions of electrolytes. Electrolytic dissociation. S. Arrhenius theory. Acid and base theory. Stepwise dissociation. Degree of dissociation. Strong and weak electrolytes. Dissociation constant. The importance of the theory of electrolytic dissociation in technology.

Properties of electrolyte solutions, ionic activity. Ionic equations of solutions. Solutions of acids, bases, and salts and ion exchange reactions between them. Ionic density of water. Solution environment. Indicators. Hydrogen indicator. Hydrolysis. Types of hydrolysis of salts. Degree and constant of hydrolysis. Industrial applications of hydrolysis.

Module 2. Electrochemistry

Topic 7. Redox reactions. Oxidation degree and valence. Types of chemical reactions. Theory of redox reactions. Oxidants and reducing agents. Types of redox reactions. Methods for constructing equations of redox reactions: electron balance and ion-electron methods.

Topic 8. Electrochemical processes. Electrochemistry. The concept of electronic potentials of metals. Hydrogen electrode. Voltage series of metals. Nernst-Tyurin equation. Galvanic elements and their mode of operation. Electromotive force. Use of galvanic elements and their role in technology.

Electrolysis. Processes occurring at the anode and cathode. Insoluble and soluble anodes. Laws of electrolysis. The importance of electrolysis in industry. Methods of galvanoplastics and galvanostegy.

Module 3. Chemistry of metals

Topic 9. General properties of metals. Alloys. Distribution and

occurrence of metals in nature. Production of metals. Physical properties of metals. Chemical properties of metals. Dependence of the properties of metals on their location in the periodic system of elements of D.I. Mendeleev. Light and heavy metals. Use of metals.

Alloys. Types and properties of alloys. Phase diagrams. Physicochemical analysis of metal alloys. Intermetallic compounds and solid solutions of metals. Production and importance of alloys in industry.

Topic 10. Corrosion of metals and methods of protection against it. Main types of corrosion. The harm caused by corrosion to the national economy. Chemical corrosion of metals. Electrochemical corrosion and its types.

Combating corrosion of metals. Methods of protecting metals from corrosion. Isolation of metals from aggressive environments, protective layers. Electrochemical protection methods (protective, cathodic and anodic protection). Changing the properties of the corrosive environment, corrosion inhibitors and activators. The economic importance of protecting metals from corrosion.

Module 4. Fundamentals of organic chemistry

Topic 11. Classification of organic compounds. Formation of organic compounds and organic chemistry. Theoretical views on the chemical structure of organic compounds. A.M. Butlerov's classification of organic compounds. Hydrocarbons. Saturated and unsaturated hydrocarbons. Alcohols, aldehydes, ketones, carboxylic acids, esters, nitrogenous organic compounds.

Topic 12. High molecular compounds. High molecular compounds. Polymers and elastomers. Polymerization and polycondensation reactions, their mechanisms. Physicochemical, mechanical properties and uses of polymers and elastomers. Composition of plastics and elastomers. Application of plastics and plastomers in technology.

II. Instructions and recommendations for practical training:

1st semester (12 hours)

The purpose of practical training is to understand the theory, acquire skills. It is to develop the ability to consciously apply it in educational and professional activities, to confidently form one's own point of view.

1. Classes of inorganic compounds. Basic laws of chemistry.
2. Atomic and molecular structure.
3. Thermochemistry.
4. Chemical kinetics and equilibrium.
5. Hydrolysis of electrolyte solutions and salts.
6. Oxidation-reduction reaction. Corrosion of galvanic elements and metals.

III. Instructions and recommendations for laboratory exercises:

1st semester (12 hours)

1. Safety rules in chemical laboratories. Familiarity with chemical containers and equipment. Classes, production and properties of inorganic compounds. Determination of the equivalent of a metal relative to hydrogen.
2. Factors affecting the rate of a chemical reaction. Chemical equilibrium. Shift of equilibrium.
3. Determination of water hardness. Determination of solution concentration.
4. Properties of strong and weak electrolytes. Ionic equations. Hydrolysis of salts.
5. Oxidation-reduction reactions. Electrochemistry. Galvanic cell. Electrolysis process.
6. Chemical properties of metals. Corrosion of metals and methods of preventing it.

The student consolidates the theoretical knowledge gained from

	lecture classes of the subject in educational laboratory exercises. The student performs laboratory work under the supervision of a laboratory assistant and completes a report and submits it to the subject teacher. **IV. Independent learning and independent work** **1st semester (72 hours)** The competence of independent learning serves to assist students in independent self-development and increase the effectiveness of professional activity. Students perform independent work on their mobile devices under the guidance of a teacher in a traditional or electronic form. 1. The importance of chemistry in the national economy. 2. The development of the chemical industry in Uzbekistan. 3. Uzbek chemists. 4. The basic laws of chemistry. 5. Atomic structure. 6. D.I. Mendeleev's periodic law and the periodic table of elements. 7. Types of chemical bonds. 8. Structure of matter. The method of valence bonds and molecular orbitals. 9. Thermochemistry. 10. Chemical kinetics. Chemical reaction rate. 11. Chemical equilibrium. Equilibrium shift. 12. Water in nature. Water hardness. 13. Water hardness and methods of softening it. 14. Redox reactions. 15. Fundamentals of electrochemistry. 16. Batteries. Their types. 17. General properties of metals. 18. Metallurgical industry in Uzbekistan. 19. Alloys. 20. Corrosion of metals and methods of preventing it. 21. Characteristics of s-group elements. 22. p-elements. Their properties. 23. d-elements. Their properties. 24. d-elements of groups I-II (Cu, Zn, Ag, Au). 25. f-elements. Lanthanoids and actinoids. 26. Classification of organic compounds. 27. Saturated and unsaturated hydrocarbons. 28. Polymer chemistry and polymer materials. 29. Plastic masses, their importance in the national economy. 30. Mineral binders. Their importance in the national economy.
Student assessment	Assessment of student knowledge is based on the mastery of the learning material during the semester and final control (tests, assignments, written and oral work results). During the chemistry course, students are evaluated on a 100-point system. Of these, 50 points are allocated to the current and intermediate results (60% of the 50 points are current control, independent study and 40% intermediate control), and 50 points are allocated to the final control result. Students whose total score of current and intermediate points is less than 30 points are not admitted to the final control exam. A student who scores 30 or more points in the final control is considered to have mastered the subject.
Requirements for exams	The student must have fully mastered the theoretical and practical concepts of the subject, be able to correctly reflect the results of the analysis. The student must have completed the tasks given in the current and intermediate forms of independent work, assessment. At the same time, he must have received the necessary points from the current, intermediate, independent education and final tests in the relevant subject within the specified time.

	A student who has not submitted current control, intermediate control and independent education tasks, as well as who has scored less than 30 points on these tasks and types of control, will not be included in the final type of control. Also, a student who has missed 25 or more percent of the classroom hours allocated to the subject without an excuse will be expelled from this subject, will not be allowed to take the final exam and will be considered as not having mastered the relevant credits in this subject. A student who fails the final exam or scores less than 30 points on this type of exam is considered academically indebted.
Recommended Literature	**Main literature:** 1. Axmerov Q.A. va boshqalar, Umumiy va anorganik kimyo, Darslik. T.: O'zbekiston, 2017. 226 b. 2. Parpiyev N.A. Muftaxov A.T., Raximov N.R., Anorganik kimyo, Darslik. T.: O'zbekiston, 2003. 215 b. 3. Н.Л. Глинка Общая химия: Учебное пособие - М.: Интеграл-Пресс, 2002. 732 с. 4. Ахметов, Н.С. Общая и неорганическая химия / Н.С.Ахметов. - М.: Высш. шк., 2001. - 743 с. 5. Soren Prip Beier & Peter Dybdahl Hede. Essentials of Chemistry. 2013. - 180 b. 6. И.К. Доманский Строительные материалы и изделия Учебное пособие Издательство Уральского университета 2018. 208 стр. 7. Е.И.Тупикин. Химия в строительстве Учебное пособие Москва: Юрайт 2019. 181 с. 8. Г.Г. Савельев, Л.М. Смолова Общая химия Учебное пособие Издательство Томского политехнического университета 2006. - 204 с. 9. Л.Г. Коляда, Л.Г. Тарасюк Химия Учебное пособие Магнитогорск 2015. 128 с. 10. Гаршин А.П. Общая и неорганическая химия в схемах, рисунках, таблицах, химических реакциях: Учебное пособие - СПб.: Питер 2011. - 288 с. 11. M.B.Matchanova, D.A.Xolmo'minova, S.Yu.Bobomuratova "Qurilish kimyosi" o'quv qo'llanma (qayta nashr). Jizzax-2023. 12. M.N.Pozilov, D.A.Xolmo'minova, A.A.Bo'riboyev. "Kimyo". Darslik. Toshkent-2022. 13. M.B.Matchonova. "Kimyo" Darslik. Toshkent-2022. **Additional literature:** 14. Sh.M.Mirziyoyev. Erkin va farovon demokratik O'zbekiston davlatini birgalikda barpo etamiz. - T.: O'zbekiston. 2016. 15. O'zbekiston Respublikasi Prezidentining "O'zbekiston Respublikasini yanada rivojlantirish bo'yicha Harakatlar strategiyasi" to'g'risidagi farmoni. Xalq so'zi gazetasi. 2017 yil 8-fevral. 16. Yoriyev O.M. va boshqalar. Umumiy va anorganik kimyodan masala va mashqlar to'plami. O'quv qo'llanma. T.: O'z.fay. MJ. 2008. -216 b. 17. Q.M.Ahmerov, S.M.Turobjonov, S.Y.Saparov Umumiy va noorganik kimyodan laboratoriya mashg'ulotlari o'quv qo'llanma. Toshkent, O'zbekiston, 2019. 18. A.M.Eminov, Sh.M.Xakberdiyev., I.R.Ro'zmatov., F.S.Karimova "Umumiy va anorganik kimyodan amaliy va laboratoriya mashg'ulotlari" o'quv qo'llanma. Toshkent-2021. 19. M.B.Matchonova. "Kimyo fanidan laboratoriya ishlari" Darslik.

	Toshkent-2023. **Internet resources:** 1. Elektron kutubxona ma'lumotlari. www.ziyonet.uz 2. Online publishing company of eBooks. www.bookboon.com 3. Alisher Navoiy nomidagi O'zbekiston Milliy kutubxonasi. www.natlib.uz 4. Axborot kutubxona tizimlari.www.kutubxona.uz 5. O'zbekiston Respublikasi hukumat portali. http://www.uzbekistan.uz 6. Online publishing. http://www.e-plastic.ru **7.** Online publishing. http://www.sciencedinect.com