



APPROVED

The Head of the admissions committee



Ivan

SAVYTSKYI 19.04 2024

PROGRAM
professional exam in chemistry
upon admission to study for a master's degree in medicine
(for foreign citizens)

General Provisions

The professional entrance examination in Chemistry for admission to a master's degree program in medicine is conducted to assess the level of fundamental and applied chemical knowledge of entrants and to determine their readiness for advanced medical and biomedical studies.

The content of the entrance examination program is based on advanced secondary and undergraduate-level chemistry and corresponds to international academic standards required for master's-level medical education.

The program is focused on the integration of chemical knowledge with biological, biochemical, physiological and clinical processes relevant to modern medicine.

The program is structured according to the major branches of chemistry and includes the following sections:

Advanced General Chemistry, Inorganic Chemistry, Physical Chemistry Elements, Organic Chemistry, and Chemistry of Biologically Important Compounds.

The entrance examination aims to determine whether entrants are able to:

- *demonstrate deep understanding of fundamental chemical laws, theories and concepts;*
- *explain complex chemical phenomena and mechanisms relevant to medicine and biomedical sciences;*
- *analyze chemical processes at the molecular and supramolecular levels;*
- *apply chemical principles to the interpretation of biochemical, physiological and pathological processes;*
- *establish relationships between chemical structure, reactivity and biological function;*
- *solve complex theoretical and situational problems using chemical reasoning;*
- *present scientifically grounded conclusions clearly and logically in oral form.*

Form of Conduct of the Entrance Examination

The professional entrance examination in Chemistry is conducted **in oral form** as an individual interview with the examination board.

The oral examination includes:

- oral responses to advanced theoretical questions covering the content of the program;
- explanation of chemical laws, reaction mechanisms and physicochemical principles;
- analysis of problem-based and situational tasks related to medicine and biochemistry;— demonstration of the ability to integrate chemical knowledge into medical and biological contexts.

The duration of the oral entrance examination for one entrant is **up to 30 minutes**.

CONTENT OF THE PROGRAM

Section	Topic	Content
Advanced General Chemistry	Matter and Molecular Structure	Atomic and molecular structure at an advanced level. Quantum-mechanical concepts of atomic orbitals. Electron configuration of atoms and ions. Isotopes and isotopic effects. Molecular orbital theory. Hybridization and molecular geometry.
Advanced General Chemistry	Periodic Law and Periodicity	Periodic law and modern interpretation of periodic trends. Periodicity of chemical properties. Effective nuclear charge. Periodic behavior of oxidation states and coordination ability of elements.
Advanced General Chemistry	Chemical Bonding and Intermolecular Interactions	Advanced concepts of ionic, covalent and metallic bonding. Polarization effects. Hydrogen bonding and van der Waals interactions. Coordination bonds. Structure–property relationships.
Advanced General Chemistry	Chemical Thermodynamics	Basic concepts of chemical thermodynamics. Internal energy, enthalpy, entropy and Gibbs free energy. Spontaneity of chemical reactions. Thermodynamic criteria of chemical equilibrium. Applications in biological systems.
Advanced General Chemistry	Chemical Kinetics and Equilibrium	Reaction rate, rate laws, reaction order. Activation energy and catalysis. Chemical equilibrium, equilibrium constant, Le Chatelier’s principle. Acid-base and redox equilibria in biological systems.
Inorganic Chemistry	Advanced Inorganic Compounds	Complex oxides, acids, bases and salts. Hydrolysis. Buffer systems and their role in maintaining physiological pH.
Inorganic Chemistry	Coordination Chemistry	Coordination compounds: structure, nomenclature and isomerism. Coordination number. Ligands. Stability of complexes. Biological role of coordination compounds (hemoglobin, enzymes, metal-containing proteins).

Section	Topic	Content
Inorganic Chemistry	Metals and Their Biological Significance	Transition metals and their chemical properties. Bioinorganic chemistry of essential elements (Fe, Cu, Zn, Mg, Ca, Na, K). Toxicity of heavy metals and mechanisms of detoxification.
Inorganic Chemistry	Solutions and Electrochemistry	Colligative properties of solutions. Electrolytic dissociation. Electrochemical cells. Redox potentials. Electrochemical processes in biological systems.
Organic Chemistry	Structure and Reactivity of Organic Molecules	Electronic effects in organic molecules. Inductive, mesomeric and hyperconjugative effects. Reaction intermediates. Stereochemistry: optical and geometric isomerism.
Organic Chemistry	Reaction Mechanisms	Mechanisms of substitution, addition, elimination and rearrangement reactions. Free-radical, nucleophilic and electrophilic mechanisms.
Organic Chemistry	Functionalized Organic Compounds	Advanced chemistry of alcohols, phenols, aldehydes, ketones, carboxylic acids and their derivatives. Structure–reactivity relationships.
Organic Chemistry	Nitrogen-Containing Compounds	Amines, amides, heterocyclic compounds. Amino acids and peptides. Peptide bond formation and properties.
Chemistry of Biologically Important Compounds	Carbohydrates	Chemical structure and classification. Glycosidic bonds. Chemical properties and biological functions.
Chemistry of Biologically Important Compounds	Lipids	Fatty acids, triglycerides, phospholipids and steroids. Chemical properties and biological role in membranes and metabolism.
Chemistry of Biologically Important Compounds	Proteins	Primary, secondary, tertiary and quaternary structures. Chemical bonds stabilize protein structure. Denaturation and renaturation.
Chemistry of Biologically Important Compounds	Nucleic Acids	Chemical structure of DNA and RNA. Nucleotides and phosphodiester bonds. Complementarity and molecular basis of heredity.

Section	Topic	Content
Chemistry of Biologically Important Compounds	Biologically Active Substances	Vitamins, hormones and enzymes: chemical nature, mechanisms of action and medical significance. Role of water and mineral salts in biochemical processes.

ASSESSMENT CRITERIA FOR ENTRANCE EXAMINATION IN CHEMISTRY

The results of the entrance examination are evaluated on a **100–200 point scale** based on the entrant's performance during the oral interview.

To obtain a positive result, the entrant must score **at least 100 points**, corresponding to not less than **30% of the minimum required level**.

During evaluation, the examination board takes into account:

- correctness and completeness of answers;
- depth of understanding of chemical concepts and laws;
- ability to explain complex chemical mechanisms;
- application of chemical knowledge to medical and biological situations;
- logical coherence, scientific reasoning and clarity of oral speech;
- correct and appropriate use of chemical terminology.

Entrants who score less than 100 points receive an **unsatisfactory grade** and are not admitted to further participation in the competitive selection.

