MINISTRY OF HEALTH OF UKRAINE
ODESA NATIONAL MEDICAL UNIVERSITY

"APPROVED"
Rector of ONMedU
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"___" 03. 2025

PROGRAM

INTRODUCTORY TEST IN CHEMISTRY
(in remote format)
FOR FOREIGNERS AND STATELESS PERSONS

Odesa
2025

Explanatory note

The main purpose of the test is an objective and impartial assessment of the level of academic achievement of persons who graduated from high school and expressed a desire to enter the Odessa National Medical University.

The task of assessment in chemistry is to assess the knowledge and skills of participants: students' knowledge of the most important laws and theories of chemistry; knowledge of chemical language, the ability to use the names and symbols of chemical elements, the names of simple and complex substances; ability to compose chemical formulas and equations of chemical reactions, to solve computational and experimental problems; understanding the relationship between the composition, structure, physical and chemical properties of substances, methods of their extraction, areas of application; knowledge of the most important natural and artificial substances, their structure, methods of extraction and areas of application; understanding the scientific basis of certain chemical industries; awareness of some environmental issues related to chemistry; understanding the role of chemistry in solving global problems of mankind.

The program is based on the program for the preparatory department ONMedU in chemistry.

Entrance test in chemistry takes place remotely in oral form using the Microsoft Teams platform. Total number of questions - 5.

The program was discussed and approved by the Admissions Committee of Odesa National Medical University (protocol № 3 from 19.03.2025)

The program was approved by the order of the rector of Odesa National Medical University № 171-О from "21" 03. 2025.)

EVALUATION CRITERIA

The entrance test consists of 5 questions, which are evaluated at 40 points.

The maximum number of points that an applicant can receive on the entrance test in chemistry is 200 points.

The minimum number of points to be scored is 100.

CRITERIA FOR EVALUATION OF CHEMICAL TASKS

For each correct answer, the person who passes the entrance test receives 40 points. Each question is answered in no more than 3 minutes.

Problems in chemistry are evaluated by criteria, as set out in the table.

The correct answer is received. The basic concepts and formulations are substantiated and competently analyzed. Examples are given.	40
The correct answer is received, full wording, but no examples are given.	30
Incomplete answer received, correct wording, no examples.	20
The answer is incomplete, the wording is incorrect, no examples are given.	10
The entrant did not start the answer or his answer does not meet the above criteria.	0

CHEMISTRY INTRODUCTORY TEST PROGRAM

n / a	Name topics	Content of educational material
1. GENERAL CHEMISTRY		
1.1	**Basic concepts**	Atoms. Molecules. Relative atomic and relative molecular mass. The law of conservation of mass of matter. Molar mass. Mole - a measure of the amount of substance.
1.2	**Chemical element. Chemical formula. Avogadro's law.**	Chemical element. Signs of chemical elements. Chemical formula. The law of constancy of composition. Mass hour of the element. Avogadro's law and its consequences. Relative density of gases. Molar volume.

	Relative density of gases	
1.3	**The structure of the atom**	Modern model of atomic structure. Isotopes. Structure of electronic shells of atoms.
1.4	**Periodic law of DI Mendeleev. PSE**	Opening of the periodic law. Its formulation by D.I. Mendeleev and modern, based on the structure of the atom. Periodic system of elements. The meaning of the periodic law. Periods, groups, insert decades, blocks. Dependence of properties of chemical elements on their presence in PSE.
1.5	**Chemical bond**	Quantum-mechanical theory of communication. Types of chemical bonds and parameters. Electronegativity of atoms, polarity and polarization of chemical bonds, the mechanism of its formation.
1.6	**Classification of chemical reactions**	Classification of chemical reactions on various grounds. Reactions of coupling, decomposition, exchange, substitution.
1.7	**Rate of chemical reactions. Chemical equilibrium. Catalysis**	The concept of the rate of chemical reactions. Dimensionality and definition of the concentration of components. Dependence of reaction rate on concentration. Kinetic equation of reaction. Influence of temperature and pressure on the rate of reactions. Vant-Hoff's rule. Catalysis and catalysts. Catalytic reactions. Reversible reactions. Displacement of equilibrium according to the Le Chatelier principle.
1.8	**Solutions. General characteristics. Electrolyte solutions**	The concept of solutions. Classification of solutions. Means of expressing the concentration of solutions. The concept of electrolytes. Strong and weak electrolytes. Degree and constant of dissociation. Ionic equations.
1.9	**Redox reactions**	The degree of oxidation of the elements. Redox reactions. Intermolecular, intramolecular, disproportionation. Compilation of equations by electronic balance. The most important oxidants and reducing agents.
2. INORGANIC CHEMISTRY		

2.1	**Oxides. Hydroxides**	Classification of oxides. Means of production and properties of acid, basic and amphoteric oxides. Soluble and insoluble hydroxides, their production and properties.
2.2	**Acids**	Classification of acids. Obtaining oxygen-free and oxygen-containing acids. Chemical properties and applications of acids.
2.3	**Salt. Genetic connection between the main classes of inorganic compounds.**	Composition, types, nomenclature of salts. Chemical properties and means of obtaining salts. Hydrolysis of salts.
2.4	**Hydrogen. Oxygen. Water**	The position of hydrogen in PSE. Physical and chemical properties. Obtaining in the laboratory and industry. Allotropy. Physical and chemical properties of oxygen and ozone. Receiving. The structure of the water molecule. Physical and chemical properties. Biological role of water.
2.5	**Halogens and their compounds**	Provisions in the PSE. The structure of atoms. Physical and chemical properties. Obtaining in the laboratory and industry. Participation in redox reactions.
2.6	**Sulfur and its compounds**	The structure of the sulfur atom. Physical and chemical properties. Hydrogen sulfide. Oxides of sulfur (IV) and (VI). Obtaining properties. Sulfuric acid, properties, chemical bases of production of contact methods. Participation in redox reactions.
2.7	**Elements of the main subgroup of the PSE group. Nitrogen and its compounds. Phosphorus and its compounds**	General characteristics of the elements of the nitrogen subgroup. Nitrogen. Physical and chemical properties. Ammonia. Industrial production, properties. Ammonium salts. Nitric acid. Features of chemical properties of nitric acid, its production. Participation in redox reactions. Allotropic forms of phosphorus. Physical and chemical properties of phosphorus. Phosphorus oxide (V). Orthophosphate acid and its salts.
2.8	**Elements of the carbon subgroup. Carbon and its compounds. Silicon**	Carbon, its allotropic forms. Physical and chemical properties. Oxides of carbon (II) and (IV), carboxylic acid and its salts. Silicon, physical and chemical properties. Silica (IV) oxide, silicate acid. Silicon compounds in nature, its use in technology.

2.9	**Alkali and alkaline earth metals**	General characteristics of elements of subgroups of lithium and beryllium. Alkali and alkaline earth metals and their properties. Receiving. Compounds of sodium, potassium, calcium in nature.
2.10	**Aluminum and its compounds**	Position of aluminum in PSE. Forms of its compounds. Aluminum oxide and hydroxide, their amphotericity. Aluminum compounds in nature, application in engineering
2.11	**Iron. Iron alloys**	Characteristics of iron by position in PSE. The degree of oxidation of iron and the form of its compounds. Oxides and hydroxides of iron (II) and (III).
2.12	**General characteristics of metals**	Position of metal elements in PSE. Electronic structure. Methods of obtaining. A number of activities of metals. Corrosion.
	3. ORGANIC CHEMISTRY	
3.1	**Theory of chemical structure. Nomenclature and classification of organiccompounds**	The subject of organic chemistry. A.M. Butlerov's theory of chemical structure of organic compounds. Types of bonds in molecules of organic compounds. Mechanisms of their formation and ways of rupture. Classification of organic compounds. Nomenclature. The concept of isomerism.
3.2	**Saturated hydrocarbons**	Homologous series of alkanes. The concept of hybridization. Spatial and electronic structure of saturated hydrocarbons. Their chemical and physical properties. Receipt and use.
3.3	**Unsaturated hydrocarbons**	Homologous series of alkenes, alkynes. The concept of hybridization. Spatial and electronic structure of unsaturated hydrocarbons. Their chemical and physical properties. Receipt and use.
3.4	**Aromatic carbohydrates. Benzene and its homologues**	Electronic structure and chemical properties of benzene. Industrial methods of obtaining benzene. The mutual influence of atoms on the example of toluene. Orientation rules in the benzene nucleus.
3.5	**Hydro compounds. Monoatomic and polyhydric alcohols. Phenols**	General formula, nomenclature, isomerism of saturated monohydric alcohols, their properties and methods of production. Polyhydric alcohols. Chemical properties of ethylene glycol and glycerol. The structure of the phenol molecule. Electronic effects and interaction of atoms in the phenol molecule. Chemical properties of phenol in comparison with the properties of alcohols.

3.6	**Aldehydes**	General formula of aldehydes. Electronic structure of aldehyde group. Nomenclature and isomerism of aldehydes. Chemical properties.
3.7	**Carboxylic acids**	Nomenclature and isomerism of carboxylic acids. The structure of the carboxyl group. Physical and chemical properties of monobasic carboxylic acids, methods of their production.
3.8	**Esters, fats**	Ester communication. Nomenclature of esters. Esterification reaction and conditions of its course. Esters of low molecular weight monobasic carboxylic acids and low molecular weight monobasic alcohols. General formula of fats. Fats as a source of glycerol, Fatty acids, salts of Fatty acids-soap. Synthetic and natural fats. Chemical properties of fats.
3.9	**Carbohydrates**	General characteristics of carbohydrates and their classification. Monoses, bioses, polyoses. Carbohydrates as poly functional compounds. Carbohydrate isomerism. D- and L-genetic series
3.10	**Nitrogen-containing organic compounds. Amines**	Nomenclature. Isomerism of amines. Chemical properties of fatty amines. Structure of amines. Comparison of the main properties of aniline as an aromatic amine with fatty amines. Industrial and laboratory methods of obtaining amines.
3.11	**Amino acids. Proteins**	Isomerism and nomenclature of amino acids. Chemical properties of amino acids. Alpha amino acids as structural units of proteins. Formation of peptic bond. Levels of protein structure. Types of chemical bonds in protein molecules.
3.12	**Genetic connection between the main classes of organic compounds**	Chains of transformation of the basic classes of connections among themselves.

Program questions in chemistry, which are submitted to the entrance test:

1. What elementary particles are part of the atom?
2. What elementary particles are part of the molecule?
3. What are isotopes?
4. Give examples of metal elements.
5. Give examples of non-metallic elements.
6. What is the valence of an element?
7. What chemical bond is called ionic?

8. What chemical bond is called covalent?
9. Which connection is called hydrogen bond?
10. What types of chemical reactions do you know?
11. Give an example of a decomposition reaction.
12. What is the rate of a chemical reaction?
13. What is a catalyst?
14. What classification of oxides do you know? Give examples.
15. What compounds are called hydroxides? Give examples.
16. What compounds are called acids? Give examples.
17. What compounds are called salts? Give examples.
18. What chemical compounds do hydroxides react with?
19. What chemical compounds do acids react with?
20. Give examples of metals that react with dilute sulfuric acid.
21. Which metals do not react with dilute sulfuric acid.
22. What chemical compounds does hydrogen react with?
23. What chemical compounds does oxygen react with?
24. What chemical compounds does nitrogen react with?
25. What chemical compounds does phosphorus react with?
26. What chemical compounds does carbon react with?
27. What chemical compounds does sodium react with?
28. What chemical compounds does calcium react with?
29. What chemical compounds does iron react with?
30. What chemical compounds does copper react with?
31. What chemical compounds does orthophosphate acid react with?
32. What chemical compounds does hydrochloric acid react with?
33. What types of bonds are present in the molecules of organic compounds?
34. What is the isomerism of organic compounds?
35. Name the first representatives of the homologous series of alkanes.
36. What reactions are characteristic of alkanes?
37. What substances are formed during the combustion of methane?
38. Name the first representatives of the homologous series of alkenes.
39. What substances are formed during the combustion of ethene?
40. What reactions are characteristic of alkenes?
41. What chemical compounds can be attached to alkenes?
42. What are the reactions of benzene?
43. What chemical compounds does benzene react with?
44. What is the functional group of alcohols?
45. What chemical compounds do alcohols react with?
46. What are the reactions of alcohols?

47. What functional group is included in aldehydes?
48. What reactions are characteristic of aldehydes?
49. What functional group is included in carboxylic acids?
50. What chemical compounds do carboxylic acids react with?

LITERATURE

1. Richard Post. Chemistry: Concepts and Problems / Richard Post, Chad Snyder, Clifford C. Houk // A Self-Teaching Guide, Jossey-Bass, 2020. – 432 p. – (3rd Edition). ISBN 9781119632627.
2. Darrell D. Ebbing. General Chemistry / Darrell D. Ebbing, Steven D. Gammon. – Boston: Cengage Learnin, 2017. – 1190 c. – (Eleventh Edition). ISBN: 978-1-305-58034-3
3. William H. Brown. Introduction to Organic Chemistry / William H. Brown, Thomas Poon. – Hoboken, NJ: Wiley, 2016. – 723 c. – (6th edition). ISBN: 111887580X,9781118875803.
4. Paula Yurkanis Bruic. Organic Chemistry / Paula Yurkanis Bruic. – Santa Barbara: Pearson, 2017. – 1340 c. – (8th edition). (ISBN: 978-0134074580)
5. General chemistry : principles and modern applications / Ralph H. Petrucci, F. Geoffrey Herring, Jeffrey D. Madura, Carey Bissonnette. – Toronto: Pearson, 2016. – 1496 c. – (11th edition). (ISBN 978-0-13-293128-1)

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