Ministry of Health of Russian Federation
Federal State Autonomous Educational Institution
of Higher Education "N.I. Pirogov Russian National Research Medical University"
Ministry of Health of Russian Federation
FGAOU RNIMU named after N.I. Pirogov of the Ministry of Health of Russia

THE PROGRAM

of the Entry Test in

Chemistry

Moscow, 2026

I. Scope of application and regulatory references

The chemistry entrance test program was developed in accordance with the admission rules for bachelor's, specialist's, and master's degree programs at the Federal State Autonomous Educational Institution of Higher Education "Russian National Research Medical University named after N.I. Pirogov" of the Ministry of Health of the Russian Federation (FSAOU HE RNIMU named after N.I. Pirogov of the Ministry of Health of the Russian Federation) for the 2026/27 academic year.

The program meets the requirements of the federal state educational standards for specialties related to the fields of knowledge "Healthcare and medical sciences", "Education and Pedagogical Sciences", "Mathematical and Natural Sciences", "Agriculture and agricultural sciences".

II. Entry Test Program

Physical chemistry

1. Atomic structure

1.1 Particles in the atom and atomic radius

Candidates should be able to:

1) understand that atoms are mostly empty space surrounding a very small, dense nucleus that contains protons and neutrons; electrons are found in shells in the empty space around the nucleus

2) identify and describe protons, neutrons and electrons in terms of their relative charges and relative masses

3) understand the terms atomic and proton number; mass and nucleon number

4) describe the distribution of mass and charge within an atom

5) describe the behaviour of beams of protons, neutrons and electrons moving at the same velocity in an electric field

6) determine the numbers of protons, neutrons and electrons present in both atoms and ions given atomic or proton number, mass or nucleon number and charge

7) state and explain qualitatively the variations in atomic radius and ionic radius across a period and down a group

1.2 Isotopes

Candidates should be able to:

1) define the term isotope in terms of numbers of protons and neutrons

2) understand the notation ${}^{x}_{y}A$ for isotopes, where x is the mass or nucleon number and y is the atomic or proton number

3) state that and explain why isotopes of the same element have the same chemical properties

4) state that and explain why isotopes of the same element have different physical properties, limited to mass and density

1.3 Electrons, energy levels and atomic orbitals

Candidates should be able to:

1) understand the terms: shells, sub-shells and orbitals, principal quantum number, ground state, limited to electronic configuration

2) describe the number of orbitals making up *s*, *p* and *d* sub-shells, and the number of electrons that can fill *s*, *p* and *d* sub-shells

3) describe the order of increasing energy of the sub-shells within the first three shells and the 4s and 4p sub-shells

4) describe the electronic configurations to include the number of electrons in each shell, sub-shell and orbital

5) explain the electronic configurations in terms of energy of the electrons and inter-electron repulsion
6) determine the electronic configuration of atoms and ions given the atomic or proton number and charge, using either of the following conventions: e.g. for Fe: $1s^2 2s^2 2p^6 3s^2 3p^6 3d^6 4s^2$ (full electronic configuration) or [Ar]$3d^6 4s^2$ (shorthand electronic configuration)
7) understand and use the electrons in boxes notation
8) describe and sketch the shapes of *s* and *p* orbitals
9) describe a free radical as a species with one or more unpaired electrons

2 Atoms, molecules and stoichiometry

2.1 Relative masses of atoms and molecules
Candidates should be able to:
1) define the unified atomic mass unit as one twelfth of the mass of a carbon-12 atom
2) define relative atomic mass, A_r, relative isotopic mass, relative molecular mass, M_r, and relative formula mass in terms of the unified atomic mass unit
2.2 The mole and the Avogadro constant
Candidates should be able to:
1) define and use the term mole in terms of the Avogadro constant
2.3 Formulae
Candidates should be able to:
1) write formulae of ionic compounds from ionic charges and oxidation numbers
2) write and construct equations (which should be balanced), including ionic equations
3) define and use the terms empirical and molecular formula
4) understand and use the terms anhydrous, hydrated and water of crystallisation
5) calculate empirical and molecular formulae, using given data
2.4 Reacting masses and volumes (of solutions and gases)
Candidates should be able to:
1) perform calculations including use of the mole concept, involving:
(a) reacting masses (from formulae and equations) including percentage yield calculations
(b) volumes of gases (e.g. in the burning of hydrocarbons)
(c) volumes and concentrations of solutions
(d) limiting reagent and excess reagent
(e) deduce stoichiometric relationships from calculations

3 Chemical bonding

3.1 Electronegativity and bonding
Candidates should be able to:
1) define electronegativity as the power of an atom to attract electrons to itself
2) explain the factors influencing the electronegativities of the elements in terms of nuclear charge, atomic radius and shielding by inner shells and sub-shells
3) state and explain the trends in electronegativity across a period and down a group of the Periodic Table
4) use the differences in Pauling electronegativity values to predict the formation of ionic and covalent bonds
3.2 Ionic bonding
Candidates should be able to:

1) define ionic bonding as the electrostatic attraction between oppositely charged ions (positively charged cations and negatively charged anions)
2) describe ionic bonding

3.3 Metallic bonding

Candidates should be able to:

1) define metallic bonding as the electrostatic attraction between positive metal ions and delocalised electrons

3.4 Covalent bonding and coordinate (dative covalent) bonding

Candidates should be able to:

1) define covalent bonding as electrostatic attraction between the nuclei of two atoms and a shared pair of electrons
(a) describe covalent bonding in molecules
(b) understand that elements in period 3 can expand their octet
(c) describe coordinate (dative covalent) bonding
2) (a) describe covalent bonds in terms of orbital overlap giving σ and π bonds
(b) describe how the σ and π bonds form in molecules
(c) use the concept of hybridisation to describe *sp*, sp^2 and sp^3 orbitals
3) (a) define the terms: bond energy as the energy required to break one mole of a particular covalent bond in the gaseous state, bond length as the internuclear distance of two covalently bonded atoms
(b) use bond energy values and the concept of bond length to compare the reactivity of covalent molecules

3.5 Intermolecular forces, electronegativity and bond properties

Candidates should be able to:

1) (a) describe hydrogen bonding, limited to molecules containing N–H and O–H groups, including ammonia and water as simple examples
(b) use the concept of hydrogen bonding to explain the anomalous properties of H_2O (ice and water): its relatively high melting and boiling points, its relatively high surface tension, the density of the solid ice compared with the liquid water
2) use the concept of electronegativity to explain bond polarity and dipole moments of molecules

4 States of matter

4.1 Bonding and structure

Candidates should be able to:

1) describe, in simple terms, the lattice structure of a crystalline solid which is:
(a) giant ionic, including sodium chloride and magnesium oxide
(b) simple molecular, including iodine, buckminsterfullerene C60 and ice
(c) giant molecular, including silicon(IV) oxide, graphite and diamond
(d) giant metallic, including copper
2) describe, interpret and predict the effect of different types of structure and bonding on the physical properties of substances, including melting point, boiling point, electrical conductivity and solubility
3) deduce the type of structure and bonding present in a substance from given information

5 Chemical energetics

5.1 Enthalpy change, Δ*H*

Candidates should be able to:

1) understand that chemical reactions are accompanied by enthalpy changes and these changes can be

exothermic (ΔH is negative) or endothermic (ΔH is positive)
2) construct and interpret a reaction pathway diagram, in terms of the enthalpy change of the reaction and of the activation energy
3) define and use the terms:
(a) standard conditions (this syllabus assumes that these are 298 K and 101 kPa)
(b) enthalpy change with particular reference to: reaction, ΔH_r , formation, ΔH_f , combustion, ΔH_c , neutralisation, ΔH_{neut}
4) understand that energy transfers occur during chemical reactions because of the breaking and making of chemical bonds

6 Electrochemistry

6.1 Redox processes: electron transfer and changes in oxidation number (oxidation state)
Candidates should be able to:
1) calculate oxidation numbers of elements in compounds and ions
2) use changes in oxidation numbers to help balance chemical equations
3) explain and use the terms redox, oxidation, reduction and disproportionation in terms of electron transfer and changes in oxidation number
4) explain and use the terms oxidising agent and reducing agent
5) indicate the magnitude of the oxidation number of an element

7 Equilibria

7.1 Chemical equilibria: reversible reactions, dynamic equilibrium
Candidates should be able to:
1) (a) understand what is meant by a reversible reaction
(b) understand what is meant by dynamic equilibrium in terms of the rate of forward and reverse reactions being equal and the concentration of reactants and products remaining constant
(c) understand the need for a closed system in order to establish dynamic equilibrium
2) define Le Chatelier's principle as: if a change is made to a system at dynamic equilibrium, the position of equilibrium moves to minimise this change
3) use Le Chatelier's principle to deduce qualitatively (from appropriate information) the effects of changes intemperature, concentration, pressure or presence of a catalyst on a system at equilibrium
4) deduce expressions for equilibrium constants in terms of concentrations, K_c
5) calculate the quantities present at equilibrium, given appropriate data
6) state whether changes in temperature, concentration or pressure or the presence of a catalyst affect the value of the equilibrium constant for a reaction
7.2 Arrhenius and Brønsted–Lowry theory of acids and bases
Candidates should be able to:
1) state the names and formulae of the common acids
2) state the names and formulae of the common alkalis
3) describe the Brønsted–Lowry theory of acids and bases
4) describe strong acids and strong bases as fully dissociated in aqueous solution and weak acids and weak bases as partially dissociated in aqueous solution
5) appreciate that water has pH of 7, acid solutions pH of below 7 and alkaline solutions pH of above 7
6) explain qualitatively the differences in behaviour between strong and weak acids including the reaction with a reactive metal and difference in pH values by use of a pH meter, universal indicator or conductivity

7) understand that neutralisation reactions occur when $H^+(aq)$ and $OH^-(aq)$ form $H_2O_{(l)}$
8) understand that salts are formed in neutralisation reactions

8 Reaction kinetics

8.1 Rate of reaction
Candidates should be able to:
1) explain and use the term rate of reaction, frequency of collisions, effective collisions and non-effective collisions
2) explain qualitatively, in terms of frequency of effective collisions, the effect of concentration and pressure changes on the rate of a reaction
3) use experimental data to calculate the rate of a reaction
8.2 Effect of temperature on reaction rates and the concept of activation energy
Candidates should be able to:
1) define activation energy, E_A, as the minimum energy required for a collision to be effective
8.3 Homogeneous and heterogeneous catalysts
Candidates should be able to:
1) explain and use the terms catalyst and catalysis
(a) explain that, in the presence of a catalyst, a reaction has a different mechanism, i.e. one of lower activation energy
(b) construct and interpret a reaction pathway diagram, for a reaction in the presence and absence of an effective catalyst

Inorganic chemistry

9 The Periodic Table: chemical periodicity

9.1 Periodicity of physical properties of the elements in Period 3
Candidates should be able to:
1) describe qualitatively (and indicate the periodicity in) the variations in atomic radius, ionic radius, melting point and electrical conductivity of the elements
2) explain the variation in melting point and electrical conductivity in terms of the structure and bonding of the elements
9.2 Periodicity of chemical properties of the elements in Period 3
1) describe, and write equations for, the reactions of the elements with oxygen
2) state and explain the variation in the oxidation number of the oxides and chlorides in terms of their outer shell (valence shell) electrons
3) describe, and write equations for, the reactions, if any, of the oxides with water including the likely pHs of the solutions obtained
4) describe, explain, and write equations for, the acid / base behaviour of the oxides and the hydroxides including, where relevant, amphoteric behavior in reactions with acids and bases
5) describe, explain, and write equations for, the reactions of the chlorides with water including the likely pHs of the solutions obtained
6) explain the variations and trends in terms of bonding and electronegativity
7) suggest the types of chemical bonding present in the chlorides and oxides from observations of their chemical and physical properties
9.3 Chemical periodicity of other elements
Candidates should be able to:
1) predict the characteristic properties of an element in a given group by using knowledge of chemical

periodicity
2) deduce the nature, possible position in the Periodic Table and identity of unknown elements from given information about physical and chemical properties

10 Group 2

10.1 Similarities and trends in the properties of the Group 2 metals, magnesium to barium, and their compounds
Candidates should be able to:
1) describe, and write equations for, the reactions of the elements with oxygen, water and dilute hydrochloric and sulfuric acids
2) describe, and write equations for, the reactions of the oxides, hydroxides and carbonates with water and dilute hydrochloric and sulfuric acids
3) describe, and write equations for, the thermal decomposition of the nitrates and carbonates, to include the trend in thermal stabilities

11 Group (7) 17

11.1 Physical properties of the Group 17 elements
Candidates should be able to:
1) describe the colours and the trend in volatility of chlorine, bromine and iodine
2) describe and explain the trend in the bond strength of the halogen molecules
3) interpret the volatility of the elements in terms of instantaneous dipole–induced dipole forces
11.2 The chemical properties of the halogen elements and the hydrogen halides
Candidates should be able to:
1) describe the relative reactivity of the elements as oxidising agents
2) describe the reactions of the elements with hydrogen and explain their relative reactivity in these reactions
3) describe the relative thermal stabilities of the hydrogen halides and explain these in terms of bond strengths
4) describe the relative reactivity of halide ions as reducing agents
11.3 The reactions of chlorine
Candidates should be able to:
1) describe and interpret, in terms of changes in oxidation number, the reaction of chlorine with cold and with hot aqueous sodium hydroxide and recognise these as disproportionation reactions

12 Nitrogen and sulfur

12.1 Nitrogen and sulfur
Candidates should be able to:
1) explain the lack of reactivity of nitrogen, with reference to triple bond strength and lack of polarity
2) describe and explain:
(a) the basicity of ammonia, using the Brønsted–Lowry theory
(b) the structure of the ammonium ion and its formation by an acid–base reaction
(c) the displacement of ammonia from ammonium salts by an acid–base reaction
3) state and explain the natural and man-made occurrences of oxides of nitrogen and their catalytic removal from the exhaust gases of internal combustion engines
4) describe the role of NO and NO_2 in the formation of acid rain both directly and in their catalytic role in the oxidation of atmospheric sulfur dioxide

Organic chemistry

13 An introduction to organic chemistry

13.1 Formulae, functional groups and the naming of organic compounds

Candidates should be able to:

1) define the term hydrocarbon as a compound made up of C and H atoms only

2) understand that alkanes are simple hydrocarbons with no functional group

3) understand that the compounds contain a functional group which dictates their physical and chemical properties

4) interpret and use the general, structural, displayed and skeletal formulae of the classes of compound

5) understand and use systematic nomenclature of simple aliphatic organic molecules with functional groups

6) deduce the molecular and/or empirical formula of a compound, given its structural, displayed or skeletal formula

13.2 Characteristic organic reactions

Candidates should be able to:

1) interpret and use the following terminology associated with types of organic compounds and reactions:

(a) homologous series

(b) saturated and unsaturated

(c) homolytic and heterolytic fission

(d) free radical, initiation, propagation, termination

(e) nucleophile, electrophile, nucleophilic, electrophilic

(f) addition, substitution, elimination, hydrolysis, condensation

(g) oxidation and reduction

2) understand and use the following terminology associated with types of organic mechanisms:

(a) free-radical substitution

(b) electrophilic addition

(c) nucleophilic substitution

(d) nucleophilic addition

13.3 Shapes of organic molecules; σ and π bonds

Candidates should be able to:

1) describe organic molecules as either straight-chained, branched or cyclic

2) describe and explain the shape of, and bond angles in, molecules containing *sp*, sp^2 and sp^3 hybridised atoms

3) describe the arrangement of σ and π bonds in molecules containing *sp*, sp^2 and sp^3 hybridised atoms

4) understand and use the term planar when describing the arrangement of atoms in organic molecules, for example ethane

13.4 Isomerism: structural and stereoisomerism

Candidates should be able to:

1) describe structural isomerism and its division into chain, positional and functional group isomerism

2) describe stereoisomerism and its division into geometrical (cis/trans) and optical isomerism

3) describe geometrical (cis/trans) isomerism in alkenes, and explain its origin in terms of restricted rotation due to the presence of π bonds

4) explain what is meant by a chiral centre and that such a centre gives rise to two optical isomers (enantiomers)

5) identify chiral centres and geometrical (cis/trans) isomerism in a molecule of given structural formula including cyclic compounds
6) deduce the possible isomers for an organic molecule of known molecular formula

14 Hydrocarbons

14.1 Alkanes
Candidates should be able to:
1) recall the reactions (reagents and conditions) by which alkanes can be produced:
(a) addition of hydrogen to an alkene in a hydrogenation reaction, $H_2(g)$ and Pt/Ni catalyst and heat
(b) cracking of a longer chain alkane, heat with Al_2O_3
2) describe:
(a) the complete and incomplete combustion of alkanes
(b) the free-radical substitution of alkanes by Cl_2 or Br_2 in the presence of ultraviolet light, as exemplified by the reactions of ethane
3) describe the mechanism of free-radical substitution with reference to the initiation, propagation and termination steps
4) suggest how cracking can be used to obtain more useful alkanes and alkenes of lower M_r from heavier crude oil fractions
5) understand the general unreactivity of alkanes, including towards polar reagents in terms of the strength of the C–H bonds and their relative lack of polarity
14.2 Alkenes
Candidates should be able to:
1) recall the reactions (including reagents and conditions) by which alkenes can be produced:
(a) elimination of HX from a halogenoalkane by ethanolic NaOH and heat
(b) dehydration of an alcohol, by using a heated catalyst (e.g. Al_2O_3) or a concentrated acid
(c) cracking of a longer chain alkane
2) describe the following reactions of alkenes:
(a) the electrophilic addition of
(i) hydrogen in a hydrogenation reaction, $H_2(g)$ and Pt/Ni catalyst and heat
(ii) steam, $H_2O(g)$ and H_3PO_4 catalyst
(iii) a hydrogen halide, HX(g) at room temperature
(iv) a halogen, X_2
(b) the oxidation by cold dilute acidified $KMnO_4$ to form the diol
(c) the oxidation by hot concentrated acidified $KMnO_4$ leading to the rupture of the carbon–carbon double bond and the identities of the subsequent products to determine the position of alkene linkages in larger molecules
(d) addition polymerisation exemplified by the reactions of ethene and propene
3) describe the use of aqueous bromine to show the presence of a C=C bond
4) describe the mechanism of electrophilic addition in alkenes, using bromine / ethene and hydrogen bromide / propene as examples
5) describe and explain the inductive effects of alkyl groups on the stability of primary, secondary and tertiary cations formed during electrophilic addition (this should be used to explain Markovnikov addition)
14.3 Cycloalkanes
Candidates should be able to:
1) describe and explain structure, homologous series, nomenclature, isomerism.

2) describe and explain chemical properties: most common addition reactions: halogenation, addition of alkyl halides, hyration, hydratation, nitration.

14.4 Aromatic hydrocarbons. Arenes

Candidates should be able to:

1) describe and explain chemical and electronic structures of benzene. Benzene- cyclic conjugated system. Conjugation energy. Homologous series of benene, nomenclature, isomerism.

2) describe and explain chemical properties of benzene: reactions of electrophilic substitution (nitration, sulfonation, halogenation, alkylation – with halogenated alkanes, reactions with alkenes; acylation).

3) describe and explain electrophilic substitution mechanism.

4) describe and explain addition reactions (addition of hydrogen, halogens).

5) describe and explain chemical properties of benzene homologues. Mutual influence of atoms in cyclic hydrocarbons. Orientation in benzene rings.

6) describe and explain oxidation reaction.

15 Halogen compounds

15.1 Halogenoalkanes

Candidates should be able to:

1) recall the reactions (reagents and conditions) by which halogenoalkanes can be produced:

(a) the free-radical substitution of alkanes by Cl_2 or Br_2 in the presence of ultraviolet light, as exemplified by the reactions of ethane

(b) electrophilic addition of an alkene with a halogen, X_2, or hydrogen halide, HX(g), at room temperature

(c) substitution of an alcohol, e.g. by reaction with HX or KBr with H_2SO_4 or H_3PO_4; or with PCl_3 and heat; or with PCl_5; or with $SOCl_2$

2) classify halogenoalkanes into primary, secondary and tertiary

3) describe the following nucleophilic substitution reactions:

(a) the reaction with NaOH(aq) and heat to produce an alcohol

(b) the reaction with KCN in ethanol and heat to produce a nitrile

(c) the reaction with NH_3 in ethanol heated under pressure to produce an amine

(d) the reaction with aqueous silver nitrate in ethanol as a method of identifying the halogen present as exemplified by bromoethane

4) describe the elimination reaction with NaOH in ethanol and heat to produce an alkene as exemplified by bromoethane

5) describe and explain the different reactivities of halogenoalkanes (with particular reference to the relative strengths of the C–X bonds as exemplified by the reactions of halogenoalkanes with aqueous silver nitrates)

16 Hydroxy compounds

16.1 Alcohols

Candidates should be able to:

1) recall the reactions (reagents and conditions) by which alcohols can be produced:

(a) electrophilic addition of steam to an alkene, H_2O(g) and H_3PO_4 catalyst

(b) reaction of alkenes with cold dilute acidified potassium manganate(VII) to form a diol

(c) substitution of a halogenoalkane using NaOH(aq) and heat

(d) reduction of an aldehyde or ketone

(e) hydrolysis of an ester using dilute acid or dilute alkali and heat

2) describe:
(a) the reaction with oxygen (combustion)
(b) substitution to halogenoalkanes, e.g. by reaction with HX or KBr with H_2SO_4 or H_3PO_4; or with PCl_3 and heat; or with PCl_5; or with $SOCl_2$ (c) the reaction with Na(s)
(d) oxidation with acidified $K_2Cr_2O_7$ or acidified $KMnO_4$ to:
(i) carbonyl compounds by distillation
(ii) carboxylic acids by refluxing (primary alcohols give aldehydes which can be further oxidised to carboxylic acids, secondary alcohols give ketones, tertiary alcohols cannot be oxidised)
(e) dehydration to an alkene, by using a heated catalyst, e.g Al_2O_3or a concentrated acid
(f) formation of esters by reaction with carboxylic acids and concentrated H_2SO_4 or H_3PO_4 as catalyst as exemplified by ethanol
3) (a) classify alcohols as primary, secondary and tertiary alcohols, to include examples with more than one alcohol group
(b) state characteristic distinguishing reactions, e.g. mild oxidation with acidified $K_2Cr_2O_7$, colour change from orange to green
4) explain the acidity of alcohols compared with water

16.2 Phenols

Candidates should be able to:

1) describe and explain structure of phenols, nomenclature and isomerism
2) describe and explain chemical properties: acidic properties, reactions of electrophilic substitution in benzene rings (nitration, sulfonation, reaction with bromine water), reduction reactions.

17 Carbonyl compounds

17.1 Aldehydes and ketones

Candidates should be able to:

1) recall the reactions (reagents and conditions) by which aldehydes and ketones can be produced:
(a) the oxidation of primary alcohols using acidified $K_2Cr_2O_7$ or acidified $KMnO_4$ and distillation to produce aldehydes
(b) the oxidation of secondary alcohols using acidified $K_2Cr_2O_7$ or acidified $KMnO_4$ and distillation to produce ketones
2) describe:
(a) the reduction of aldehydes and ketones, using $NaBH_4$ or $LiAlH_4$ to produce alcohols
(b) the reaction of aldehydes and ketones with HCN, KCN as catalyst, and heat to produce hydroxynitriles
3) deduce the nature (aldehyde or ketone) of an unknown carbonyl compound from the results of simple tests (Fehling's and Tollens' reagents; ease of oxidation)

18 Carboxylic acids and derivatives

18.1 Carboxylic acids

Candidates should be able to:

1) recall the reactions by which carboxylic acids can be produced:
(a) oxidation of primary alcohols and aldehydes with acidified $K_2Cr_2O_7$ or acidified $KMnO_4$ and refluxing
(b) hydrolysis of nitriles with dilute acid or dilute alkali followed by acidification
(c) hydrolysis of esters with dilute acid or dilute alkali and heat followed by acidification
2) describe:

(a) the redox reaction with reactive metals to produce a salt and $H_2(g)$
(b) the neutralisation reaction with alkalis to produce a salt and $H_2O(l)$
(c) the acid–base reaction with carbonates to produce a salt and $H_2O(l)$ and $CO_2(g)$
(d) esterification with alcohols with concentrated H_2SO_4 as catalyst

18.2 Esters

Candidates should be able to:

1) recall the reaction (reagents and conditions) by which esters can be produced:
(a) the condensation reaction between an alcohol and a carboxylic acid with concentrated H_2SO_4 as catalyst
2) describe the hydrolysis of esters by dilute acid and by dilute alkali and heat

19 Nitrogen compounds

19.1 Primary amines

Candidates should be able to:

1) recall the reactions by which amines can be produced:
(a) reaction of a halogenoalkane with NH_3 in ethanol heated under pressure

20 Polymerisation

20.1 Addition polymerisation

Candidates should be able to:

1) describe addition polymerisation as exemplified by poly(ethene) and poly(chloroethene), PVC
2) deduce the repeat unit of an addition polymer obtained from a given monomer
3) identify the monomer(s) present in a given section of an addition polymer molecule
4) recognise the difficulty of the disposal of poly(alkene)s, i.e. non-biodegradability and harmful combustion products

21 Organic synthesis

21.1 Organic synthesis

Candidates should be able to:

1) for an organic molecule containing several functional groups:
(a) identify organic functional groups using the reactions in the syllabus
(b) predict properties and reactions
2) devise multi-step synthetic routes for preparing organic molecules using the reactions in the syllabus
3) analyse a given synthetic route in terms of type of reaction and reagents used for each step of it, and possible by-products

III. The form of the entrance test

The introductory test in chemistry is conducted in the form of electronic testing. The execution time is 210 minutes.

The tasks of the entry test in chemistry are presented on the website of the RNIMU named after N.I.Pirogov at the link: https://admex.rsmu.ru

IV. Indicators and criteria for the result of the entrance examination, scale and assessment procedure

The results of passing the entry test show the degree (level) of assimilation of theoretical educational material in the discipline and the level of formation of skills and abilities.

Criteria that determine the degree (level) of assimilation of theoretical educational material in the discipline at the entrance test:

• the correctness of the answer to the question;

• volume (completeness) of theoretical knowledge within the program material.

Criteria that determine the level of formation of skills and abilities in the discipline at the entrance test:

• correct implementation of the algorithm for solving a practical problem;

• correct interpretation of the obtained results;

• the ability to draw conclusions from the data obtained.

The criteria for evaluating test questions in points are given in the Table.

№	Question topics	Maximum score
1	Electronic configuration of an atom	2 0 score for an error
2	Patterns of change in chemical properties. Characteristics of elements.	2 0 score for an error
3	Electronegativity, oxidation state and valence of chemical elements.	2 0 score for an error
4	Charasteristics of chemical bonds. Dependence of the chemical properties on the composition and structure.	2 0 score for an error
5	Classification and nomenclature of inorganic substances.	3 0 score for an error
6	Properties of simple substances and oxides.	2 0 score for an error
7	Properties of amphoteric hydroxides, acids and salts.	2 0 score for an error
8	Properties of inorganic substances	4 minus a score for each mistake
9	Interrelation of various classes of inorganic substances	4 minus a score for each mistake
10	Ion exchange and dissociation	4 minus a score for each mistake
11	Classification and nomenclature of organic compounds	4 minus a score for each mistake
12	The theory of the chemical structure of organic compounds	2 0 score for an error
13	Properties of hydrocarbons.	2 0 score for an error
14	Properties of oxygen containing compounds.	2 0 score for an error
15	Properties of nitrogen containing compounds.	2 0 score for an error
16	Classification of chemical reactions in organic and inorganic chemistry.	2 0 score for an error
17	The reaction rate and its dependence on different factors	2 0 score for an error
18	Oxidation-reduction reactions.	3 minus a score for each mistake
19	Characteristic properties of different classes of organic compounds.	4 minus a score for each mistake
20	Properties of hydrocarbons and oxygen containing compounds.	4 minus a score for each mistake
21	Qualitative reactions of organic compounds.	4 minus a score for each mistake
22	The relationship of inorganic compounds: chains of transformations	4

		minus a score for each mistake
23	Hydrolysis of salts.	4 minus a score for each mistake
24	Chemical equilibrium.	4 minus a score for each mistake
25	Qualitative reactions of inorganic compounds.	4 minus a score for each mistake
26	Media of water solutions of salts.	4 minus a score for each mistake
27	Interrelation of different classes of inorganic substances and reactions description.	4 minus a score for each mistake
28	Interrelation of organic compounds.	3 minus a score for each mistake
29	Calculation of the mass fraction of a substance in a solution	3 0 score for an error
30	Gas volume calculation.	2 0 score for an error
31	Calculation of the mass or volume by the parametres of one of the reactants.	2 0 score for an error
32	Calculations of molar concentration of a substance in solution	2 0 score for an error
33	Ion-exchange reactions.	2 0 score for an error
34	Calculation of the mass fraction of a substance in a mixture.	2 0 score for an error
35	Thermal effects of chemical reactions	2 0 score for an error
	Total score:	100

In tasks 1-7, 12-17, 29-35, the maximum score is given only with a complete correct answer; with an incorrect answer - 0 points. In tasks 8-11, 18-28 the maximum score is given with a complete correct answer; with a partially correct answer to a question, a part of the points is given depending on the number of correct answers.

The total maximum amount of the entrance test is 100 points. The sum of points is not translated into a five-point scale.

V. Recommended literature

To prepare for entrance examinations, you can use school textbooks in chemistry (preferably at the profile level) by some authors.