Program of Chemistry entrance exam in Ural State Medical University

1. The structure of the electronic shells of atoms of elements of the first four periods: s-, p- and d-elements. Electronic configuration of an atom. Ground and excited states of atoms

2. Patterns of changes in the chemical properties of elements and their compounds by periods and groups. General characteristics of metals of groups IA–IIIA in connection with their position in the Periodic Table of Chemical Elements D.I. Mendeleev and the structural features of their atoms.

3. Covalent chemical bond, its varieties and mechanisms of formation. Characteristics of covalent bonds (polarity and bond energy). Ionic bond. Metal connection. Hydrogen bond. Substances of molecular and non-molecular structure. Type of crystal lattice. Dependence of the properties of substances on their composition and structure

4. Classification of inorganic substances. Nomenclature of inorganic substances (trivial and international).

5. Characteristic chemical properties of bases and amphoteric hydroxides. Characteristic chemical properties of acids. Characteristic chemical properties of salts: medium, acidic, basic; complex (using the example of hydroxo compounds of aluminum and zinc). Electrolytic dissociation of electrolytes in aqueous solutions. Strong and weak electrolytes. Ion exchange reactions.

6. Characteristic chemical properties of inorganic substances:

– simple substances-metals: alkali, alkaline earth, magnesium, aluminum, transition metals (copper, zinc, chromium, iron);

– simple substances – non-metals: hydrogen, halogens, oxygen, sulfur, nitrogen, phosphorus, carbon, silicon;

– oxides: basic, amphoteric, acidic;

– bases and amphoteric hydroxides;

– acids;

– salts: medium, acidic, basic; complex (using the example of hydroxo compounds of aluminum and zinc).

7. The relationship of inorganic substances: chains of transformations with the identification of unknown substances.

8. Classification of organic substances. Nomenclature of organic substances (trivial and international): hydrocarbons, oxygen-containing and nitrogen-containing compounds.

9. Theory of the structure of organic compounds: homology and isomerism (structural and spatial). Mutual influence of atoms in molecules. Types of bonds in molecules of organic substances. Hybridization of carbon atomic orbitals. Radical. Functional group.

10. Characteristic chemical properties of hydrocarbons: alkanes, cycloalkanes, alkenes, dienes, alkynes, aromatic hydrocarbons (benzene and homologues of benzene, styrene). The most important

methods for producing hydrocarbons. Ionic (V.V. Markovnikov's rule) and radical reaction mechanisms in organic chemistry.

11. Characteristic chemical properties of saturated monohydric and polyhydric alcohols, phenol, aldehydes, ketones, carboxylic acids, esters. The most important methods for obtaining oxygen-containing organic compounds

12. The relationship of hydrocarbons, oxygen-containing and nitrogen-containing organic compounds: chains of transformations with the identification of unknown substances.

13. Electrolysis of melts and solutions (salts, alkalis, acids).

14. Hydrolysis of salts. Aqueous solution environment: acidic, neutral, alkaline. Establishing patterns in changes in pH of aqueous solutions of acids, alkalis, salts, and binary compounds.

15. Reversible and irreversible chemical reactions. Chemical balance. Le Chatelier's principle. Shift of equilibrium under the influence of various factors

16. Calculations using the concept of "mass fraction of a substance in solution".

17. Calculations using thermochemical equations.

18. Redox reactions. The most important oxidizing agents and reducing agents, oxidation and reduction processes. Electronic balance.

19. . Calculations using the concepts of "solubility", "mass fraction of a substance in solution". Calculations of the mass (volume, amount of substance) of the reaction products, if one of the substances is given in excess (has impurities). Calculations of the mass (volume, amount of substance) of the reaction product, if one of the substances is given as a solution with a certain mass fraction of the dissolved substance. Calculations of the mass or volume fraction of the yield of the reaction product from the theoretically possible. Calculations of the mass fraction (mass) of a chemical compound in a mixture.

20. Establishment of a molecular formula and the name of an organic substance, determination of the type of chemical reaction involving this substance.