

Theoretical Foundations of Chemistry

Modern ideas about the structure of an atom

- The structure of the electron shells of the atoms of the elements of the first four periods: s-, p- and d-elements.
- Electronic configuration of atoms and ions. The ground and excited state of the atoms

Periodic Law and Periodic System of Chemical Elements Mendeleev's

- Regularities in changing the properties of elements and their compounds by periods and groups
- General characteristics of metals IA-III A groups in connection with their position in the Periodic System of Chemical Elements Mendeleev and the peculiarities of the structure of their atoms
- Characteristic of the transition elements (copper, zinc, chromium, iron) according to their position in the periodic system of chemical elements Mendeleev and the peculiarities of the structure of their atoms
- General characteristics of IVA-VII A non-metals in connection with their position in the Periodic System of Chemical Elements Mendeleev and the peculiarities of the structure of their atoms

Chemical bond and substance structure

- Covalent chemical bond, its varieties and mechanisms of education. Characteristics of the covalent bond (polarity and binding energy). Ionic bonding. Metal bonding. Hydrogen bond
- Electronegativity. The degree of oxidation and valence of chemical elements
- Substances of molecular and non-molecular structure. Type of crystal lattice. Dependence of properties of substances on their composition and structure

Chemical reactions

- Classification of chemical reactions in inorganic and organic chemistry
- The thermal effect of a chemical reaction. Thermochemical equations
- The rate of the chemical reaction, its dependence on various factors
- Reversible and irreversible chemical reactions. Chemical equilibrium. The displacement of chemical equilibrium under the influence of various factors
- Electrolytic dissociation of electrolytes in aqueous solutions. Strong and weak electrolytes
- Ion exchange reactions
- Hydrolysis of salts. Medium of aqueous solutions: acidic, neutral, alkaline
- Oxidation-reduction reactions. Corrosion of metals and ways to protect against it
- Electrolysis of melts and solutions (salts, alkalis, acids)
- Ionic (V.V. Markovnikova's rule) and radical mechanisms of reactions in organic chemistry

Inorganic chemistry

- Classification of inorganic substances. Nomenclature of inorganic substances (trivial and international)
- Characteristic chemical properties of simple substances - metals: alkali, alkaline earth, magnesium, aluminum; transition metals (copper, zinc, chromium, iron)
- Characteristic chemical properties of simple substances - non-metals: hydrogen, halogens, oxygen, sulfur, nitrogen, phosphorus, carbon, silicon
- Characteristic chemical properties of oxides: basic, amphoteric, acidic
- Characteristic chemical properties of bases and amphoteric hydroxides

- Characteristic chemical properties of acids
- Characteristic chemical properties of salts: medium, acidic, basic; Complex (on the example of aluminum and zinc compounds)
- The relationship of different classes of inorganic substances

Organic chemistry

- Theory of the structure of organic compounds: homology and isomerism (structural and spatial). The mutual influence of atoms in molecules
- Types of bonds in molecules of organic substances. Hybridization of atomic carbon orbitals.
- Classification of organic substances. Nomenclature of organic substances (trivial and international)
- Characteristic chemical properties of hydrocarbons: alkanes, cycloalkanes, alkenes, dienes, alkynes, aromatic hydrocarbons (benzene and homologues of benzene, styrene).
- Characteristic chemical properties of the limiting monohydric and polyhydric alcohols, phenol. Characteristic chemical properties of aldehydes, carboxylic acids, esters.
- Characteristic chemical properties of nitrogen-containing organic compounds: amines and amino acids.
- The most important ways to produce amines and amino acids
- Biologically important substances: fats, proteins, carbohydrates (monosaccharides, disaccharides, polysaccharides)
- Interconnection of organic compounds.

METHODS OF KNOWLEDGE IN CHEMISTRY. CHEMISTRY AND LIFE

- Rules of work in the laboratory. Laboratory utensils and equipment. Safety rules when working with caustic, flammable and toxic substances, household chemicals
- Scientific methods of research of chemicals and transformations. Methods for separation of mixtures and purification of substances
- Determination of the character of the medium of aqueous solutions of substances. Indicators
- Qualitative reactions to inorganic substances and ions
- Qualitative reactions of organic compounds
- The main methods of obtaining (in the laboratory) specific substances belonging to the studied classes inorganic compounds
- The main methods of obtaining hydrocarbons (in the laboratory)
- The main methods of obtaining organic oxygen-containing compounds (in the laboratory)

General ideas about industrial methods for obtaining essential substances

- The concept of metallurgy: general methods for obtaining metals
- General scientific principles of chemical production (on the example of industrial production of ammonia, sulfuric acid, methanol).
- Chemical pollution of the environment and its consequences
- Natural sources of hydrocarbons, their processing
- High-molecular compounds. Polymerization and polycondensation reactions. Polymers. Plastics, fibers, rubbers

Calculations by chemical formulas and reaction equations

- Calculations using the concept of "mass fraction of substance in solution"
- Calculations of volumetric ratios of gases in chemical reactions

- Calculations of the mass of a substance or volume of gases by a known amount of a substance, mass or volume one of the substances participating in the reaction
- Calculations of the thermal effect of the reaction
- Calculations of mass (volume, amount of substance) of 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 in the form of a solution with a certain mass fraction of the dissolved substance
- Establishment of a molecular and structural formula for a 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 the chemical compound in the mixture