Chemistry

Form 10 – General chemistry

1. Chemical reactivity
    a. Chemical equations;
    b. Reactions of inorganic salts, oxides, bases and acids; reaction chains;
    c. Oxidation reactions – burning materials;
    d. Chemistry of hydrogen;
    e. Formation of acid rain and greenhouse effect;
    f. Reactions between ions in solution;
    g. Exothermic and endothermic reactions, heat of reaction.
2. Quantitative relations in chemistry
    a. The mole concept and Avogadro's constant;
    b. Mass and gaseous volume relationships in chemical reactions, ideal gas law;
    c. Solutions (mass fraction, molar concentration, mass concentration);
    d. Chemical formulas, calculation of formulas form element analysis.
3. Atomic structure and periodic table
    a. Structure of atom;
    b. Electron arrangement;
    c. The periodic table;
    d. Characterization of atom from periodic table;
    e. Determination of physical properties using periodic table;
    f. Radioactive decay, chemical equations.
4. Bonding and structure
    a. Ionic bonding;
    b. Covalent bonding;
    c. Intermolecular forces;
    d. Metallic bonding;
    e. Relationship between bonding and physical properties.

Form 11 – Chemistry of elements

5. Acids and bases
    a. Properties of acids and bases;
    b. Strong and weak acids and bases;
    c. The pH scale, calculation of pH of monoprotic acid or base solution (pH = - log C);
    d. Reactions of inorganic salts, oxides, bases and acids; reaction chains;
    e. Titration and calculations using results of titration, mass fraction, molar concentration, mass concentration.
6. Oxidation and reduction
    a. Oxidation numbers;
    b. Introduction to oxidation and reduction reactions, identification of these reactions;

c. Redox equations;
d. Electrolysis;
e. Electron arrangement in atoms and ions;
f. Shapes of binary molecules and ions, hybridization.

7. Chemistry of metals – occurrence in nature, production, physical properties, chemical properties, main compounds.
    a. Alkali metals – sodium (Na) and potassium (K);
    b. Alkaline earth metals – calcium (Ca) and magnesium (Mg);
    c. Transition metals – iron (Fe), copper (Cu), zinc (Zn), chromium (Cr), gold (Au) and silver (Ag);
    d. P group metallic elements – aluminum (Al), tin (Sn) and lead (Pb).
8. Chemistry of nonmetals – occurrence in nature, production, physical properties, chemical properties, main compounds.
    a. Oxygen (O);
    b. Hydrogen (H);
    c. Nitrogen (N);
    d. Sulphur (S);
    e. Chlorine (Cl);
    f. Noble gases.
9. Industrial applications of chemistry
    a. Water hardness and its reduction;
    b. Production of oxygen;
    c. Production of chlorine, sodium hydroxide, sodium;
    d. Production of steel, stainless steel.

Form 12 – Organic chemistry

10. Chemistry of carbon
    a. Inorganic compounds of carbon – CO, CO_2, H_2CO_3, carbonates and hydrogen carbonates;
    b. Allotropy – carbon, diamond, fullerene. Physical and chemical properties of carbon allotropes. Crystal structures.
    c. Carbon occurrence in nature, production, use in industry.
11. Introduction to organic chemistry
    a. Empirical, molecular and structural formulas, calculation of formulas from element analysis data and chemical reactions;
    b. Homologous series, change of physical properties;
    c. Isomerism (up to seven carbon organic compounds);
    d. IUPAC rules of naming organic compounds (names of all organic compounds will be given according to IUPAC rules);
    e. Identification of functional groups and organic compound classes: alkanes, alkenes, cycloalkanes, alkynes, arenes, alcohols, aldehydes, ketones, carboxylic acids, amines, halogenoalkanes.

f. Relationship between structural properties and physical properties (boiling points, solubility in water).

12. Properties of organic compounds – production, physical properties, chemical reactivity (without mechanisms) and reaction pathways, use of compounds.
    a. Alkanes up to six carbon atoms in molecule;
    b. Alkenes up to four carbon atoms in molecule;
    c. Alkynes up to three carbon atoms in molecule;
    d. Benzene and toluene (methylbenzene);
    e. Chloroalkanes up to four carbon atoms in molecule;
    f. Alcohols up to four carbon atoms in molecule.