

THE LIST OF TOPICS IN CHEMISTRY

GENERAL CHEMISTRY

ATOMIC STRUCTURE. THE PERIODIC TABLE OF ELEMENTS

- Atomic energy levels and sublevels. Electron configurations. Atomic and mass number of elements. Ionization energy and electron affinity. Hund's rule. The Pauli exclusion principle.

CHEMICAL BONDS

- Ionic bond. Covalent bond (nonpolar, polar, coordinate). Hydrogen bond. Intermolecular forces.

FUNDAMENTAL CHEMICAL LAWS

- The law of definite proportion (Proust's law). The law of multiple proportions (Dalton's law). Gay-Lussac's law of combining volumes. Avogadro's law.
- Calculations with chemical formulas and equations. Stoichiometry of chemical reactions.

ENERGY CHANGES IN CHEMICAL REACTIONS.

- The internal energy of a system. Enthalpy, entropy and free energy. Thermochemical equations.

THE RATE OF CHEMICAL REACTION. CHEMICAL EQUILIBRIA

- Chemical equilibria in solutions of sparingly-soluble electrolytes – the solubility product constant.

CLASSIFICATION OF INORGANIC COMPOUNDS

- Oxides. Hydrides. Bases. Acids. Salts. Amphoteric electrolytes. The theory of acids and bases: the Proton or Brønsted-Lowry theory.

SOLUTIONS

- Quantitative expressions of concentration of a solution: molar concentration (molarity), mass concentration, molality, mole and mass fractions.
- Colligative properties of solutions
- Colloid solutions

ELECTROLYTE SOLUTIONS

- Electrolytic dissociation. Dissociation constant and degree of dissociation. Ionic concentration. Ion-product constant for water (K_w). Hydrogen ion exponent (pH).

NEUTRALIZATION. HYDROLISIS. BUFFER SOLUTIONS

OXIDATION-REDUCTION REACTIONS

- Oxidation state. Balancing oxidation-reduction equations. Oxidizing and reducing agents. Electropotential series and standard electrode potential. Electrolysis, converting chemical energy into electrical energy. Galvanic cells.

INORGANIC CHEMISTRY

- General characteristics of s-, p- and d-block elements and their compounds.

ORGANIC CHEMISTRY

STRUCTURE AND BONDING IN ORGANIC COMPOUNDS

CLASSIFICATION OF ORGANIC COMPOUNDS

ISOMERISM IN ORGANIC COMPOUNDS

HYDROCARBONS

- Alkanes (nomenclature, chemical properties)
- Alkenes (nomenclature, chemical properties)

- Alkynes (nomenclature, chemical properties)
- Alkadienes
- Cycloalkanes
- Arenes (nomenclature, chemical properties)

ALKYL AND ARYL HALOGENIDES

ORGANIC COMPOUNDS CONTAINING OXYGEN

- Alcohols (nomenclature, classification, chemical properties)
- Phenols (nomenclature, chemical properties)
- Ethers
- Aldehydes and ketones (nomenclature, chemical properties)
- Carboxylic acids (classification, nomenclature, chemical properties)
- Substituted carboxylic acids
- Carboxylic acid derivatives (acyl chlorides, anhydrides, amides and esters)
- Carbonic acid derivatives

ORGANIC COMPOUNDS CONTAINING SULFUR

ORGANIC COMPOUNDS CONTAINING NITROGEN

- Nitro compounds
- Amines
- Amino acids (nomenclature, synthesis, chemical properties)
- Peptides

HETEROCYCLIC COMPOUNDS

CARBOHYDRATES

- Monosaccharides (nomenclature, classification of monosaccharides , chemical properties)
- Oligosaccharides and polysaccharides

LIPIDS

- Fatty acids
- Neutral fats