

Chemistry

Basic chemical notions:

- homogenous and heterogenous mixtures, solution, chemical individual, matter, element, compound

Atom:

- elementary particles, atomic and mass number, nuclides, isotope, atomic and molecular mass, quantum numbers (principal, azimuthal, magnetic and spin), orbitals, Pauli's principle, Hund's rule, building-up principle, electron configuration

Element classification:

- periodicity in electronic configurations, characteristics of groups and periods, s-, p-, d- and f- elements, their basic properties and characteristics, octet rule, periodicity in chemical properties, periodical table,
- bonds between atoms in the molecules (ionic, covalent, coordinate covalent and hydrogen bond), electronegativity, polarity of covalent bond

Solutions:

- definition, concentration of solutions, osmosis, osmotic pressure, electrolytic dissociation, electrolytes

Structure of molecules

Chemical reactions

Protolytic reactions

- acids and bases, conjugated pairs, ampholytes, chemical equilibrium of acids and bases in solutions, acidity and basicity, pK value. Salts, hydrolysis of salts, autoprotolysis of water, pH

Oxidation-reduction reactions

- theory of oxidation and reduction, oxidation numbers

Chemical kinetics and thermodynamics

- reaction rates, Guldberg - Waage law, the activated complex, catalysis, chemical equilibrium, equilibrium calculation, thermodynamics laws (1st and 2nd law), reaction energy (heat)

Organic chemistry

- structure of organic compounds, division of organic compounds, nomenclature, isomerism, functional groups

Hydrocarbons

- saturated, unsaturated, aromatic, their characteristics and typical reactions

Derivatives of hydrocarbons:

- halogenderivatives
- hydroxyderivatives

Alcohols and phenols - basic characteristics and reactions. Biologically important hydroxyderivatives. Quinones.

- Oxoderivatives - ethers, structure and chemical properties, aldehydes and ketones.

Basic characteristics and chemical properties. Biologically important compounds.

- Amines - characteristics and reactions.
- Sulphur derivatives - thiols disulphides, sulphonic acids

Carboxylic acids

- basic characteristics, division, nomenclature, basic reactions, fatty acids. Biologically important acids.

Functional derivatives of carboxylic acids

- amides, esters, anhydrides – basic characteristics

Substitutional derivatives of carboxylic acids

- hydroxy-, oxo-, amino-acids, Basic characteristics and reactions, basic biological important compounds

Derivatives of carbonic acid

- structure of urea and its derivatives

Heterocyclic compounds

- division, basic characteristics. Five member heterocyclic compounds and their derivatives: aromatic nature, properties (furan, pyrrole, thiophen, indol, porphin, tetrapyroles). Six-member heterocyclic compounds and their derivatives: aromatic nature and properties (pyridine - nicotinic acid, nicotin-amide, pyrimidine - uracil, thymine, cytosine, purine - adenine, guanine, uric acid, quinoline, isoquinoline)

Natural compounds

Carbohydrates (saccharides)

- **monosaccharides** - division, basic structure and properties. Isomerism of monosaccharides (cyclic forms),
- **disaccharides** - structure and properties,
- **polysaccharides** - starch, glycogen, cellulose

Lipids

- structure of simple lipids, triacylglycerols, basic properties (hydrolysis - saponification). Complex lipids, steroids, structure of phospholipids.

Amino acids

- structure, chemical properties, isoelectric point

Proteins

- peptide bond, primary, secondary, tertiary and quaternary structure, denaturation of proteins

Heteroproteins

- division

Nucleic acids

- DNA, RNA, basic structural characteristics, biological importance, nucleosides, nucleotides

Vitamins, their importance for functions of the organism, diseases

Enzymes - general characteristics