

Chemistry Syllabus

1. Stoichiometry

Chemical formulas and the mole concept. Avogadro's constant.
Chemical reaction and equations. Mass relationship in reactions.
Calculations.

2. Atomic theory

Nuclear model of atom. Isotopes. Electron arrangement: shells, sub-shells, orbitals.
Electron configuration notation.

3. The Periodic Table of the elements

Electron configurations and the Periodic Table .
Valence configuration of atoms.
Blocks (s, p, d, f) and groups.
Periodic trends: physical properties, chemical properties.

4. Bonding

Ionic bonding.
Covalent bonding. Molecular orbitals and hybridization. Shapes of molecules and ions.
Intermolecular forces. Hydrogen bonding. Metallic bonding.

5. States of matter

Changes of state and kinetic theory. Gases. Gases Laws.

6. Energetics

Exothermic and endothermic reactions.
Standard enthalpy changes of reaction. Calculation of enthalpy change. Hess' law.
Entropy and free energy. Spontaneity of a reaction.

7. Kinetics

Reaction mechanism: collision theory. Activation energy.
Rates of reactions, rate expression. Factors affecting the rate of reaction.
Order of reaction and half-life.

8. Equilibrium law

The equilibrium law. Applications of the equilibrium law.
Calculations involving equilibrium constants.

9. Solutions

Solubility and solubility product constant. Concentrations of solutions.
Dissociation. Dissociation (ionization) constant and the degree of dissociation. Ostwald's
Dilution Law.

10. Acids and bases

Definitions of acids and bases: Arrhenius, Bronsted-Lowry, Lewis. Properties of acids and
bases. Strong and weak acids and bases.
The pH scale, pH calculations. Indicators.

Salt hydrolysis.
Calculations involving acids and bases.

11. Oxidation and reduction

Redox reactions. Definitions: reduction, oxidation, oxidizing agent (oxidant), reducing agent (reductant). Balancing of redox reactions.

12. Electrochemistry

Standard electrode potentials. Galvanic cells. Cell electromotive force (EMF). Electrolysis. Calculations in electrochemistry.

13. Organic chemistry

Isomerism (structural, geometric, optical) and tautomerism in organic compounds.

Functional groups and homologous series.

Multiple bonds.

Shapes of molecules.

Types of reactions in organic chemistry.

Hydrocarbons

Alkanes. Alkenes. Alkynes. Arenes.

Methods for preparation. Physical chemical and chemical properties. Characteristic reactions. Detection.

Halogenoalkanes

Methods for preparation. Physical chemical and chemical properties. Characteristic reactions, detection.

Alcohols, phenols and ethers

Methods for preparation. Physical chemical and chemical properties. Characteristic reactions, detection of functional groups. Distinguishing between alcohols and phenols.

Aldehydes and ketones

Methods for preparation. Physical chemical and chemical properties. Characteristic reactions, detection of functional groups. Distinguishing between aldehydes and ketones.

Carboxylic acids

Methods for preparation. Physical chemical and chemical properties. Factors affecting acidity of carboxylic acids. Characteristic reactions, detection of functional group.

Esters

Methods for synthesis of esters, esterification reaction, mechanism of esterification. Physical chemical and chemical properties. Hydrolysis of esters. Lipids and fats.

Amines and amides

Methods for preparation. Physical chemical and chemical properties. Basicity of amines. Characteristic reactions, detection of functional groups.

Amino acids, proteins.

Physical chemical and chemical properties. Condensation of amino acids, formation of peptide bond. Primary secondary tertiary and quaternary structure of proteins.

Carbohydrates

Isomerism. Monosaccharides, disaccharides, polysaccharides.

Synthetic organic polymers

Polymerization and polycondensation processes.

Most commonly used polymers