

Syllabus for Master Degree
Department of Chemistry / 2023-2024

Analytical Chemistry

Fundamentals of Analytical Chemistry:

- Methods for the expression of concentration
- Chemical Stoichiometry

Separations Techniques (Chromatography):

- Chromatographic Theories
- Chromatographic Resolutions
- Adsorption Chromatography
- Paper Chromatography
- Thin Layer Chromatography
- Ion Exchange Chromatography
- Liquid Chromatography
- High performance Liquid Chromatography
- Ion-Pair Chromatography
- Ion Chromatography
- Gas Chromatography

Instrumental Analysis:

Molecular Spectrometry

- Molecular Absorption Spectrometry
- Molecular Emission Spectrometry
- Turbidimetry and Nephelometry

Atomic Spectrometry

- Atomic Emission Spectrometry
- Atomic Absorption Spectrometry

Electrochemical techniques for analysis

- (Potentiometry)

Biochemistry

Carbohydrates

- Importance of carbohydrates
- Classes of Carbohydrates and their examples
- Glycolysis and Pentose phosphate pathway

Lipids

- Importance of Lipids
- Classes of lipids
- Omega fatty acids
- Cholesterol and Phospholipids

Protein

- Amino acids
- Classification of amino acids
- Protein structure
- Classification of protein according to their functions
- Classification of enzyme
- Mechanism of enzyme's action
- Factors affecting the activity of enzyme

Metabolism

- Digestion of carbohydrates in the body
- Glycolysis and Pentose phosphate pathway
- Metabolism of galactose
- Digestion of lipids in the body
- β -oxidation
- Biosynthesis of fatty acids

Clinical Biochemistry

- Disorders of Carbohydrate metabolism
- Disorders of lipid metabolism
- Hepatitis
- Renal function and diseases

Organic Chemistry

1- Alkyl halide

- Alkyl halide substitution reactions
- Mechanism of SN2 reaction
- Mechanism of SN1 reaction
- The stereochemistry of SN1 reaction
- The stereochemistry of SN2 reaction
- Identification of alkyl halides

2- Alkenes

- Addition of halogens to alkenes (Halogenation)
- Addition of water to symmetrical and unsymmetrical alkenes
- Stereochemistry of alkenes (cis, trans, E and Z)
- Identifications of alkene functional group

3- Spectroscopy

- Infrared spectroscopy
- Proton nuclear magnetic resonance spectroscopy

Physical Chemistry

Thermodynamic Chemistry

- Gases: Properties, definition of perfect & real gas, state of gas
- The gas law, the kinetic model of gas, application of ideal gas law
- Virial equation of state, the Van der Waal equation of state, heat Capacity of gases
- P-T-V relation of gas & liquids, principle of corresponding states
- Liquefaction of gases, Viscosity of gas & liquids
- The Zero & first law of thermodynamic – the basic concepts, work & heat, internal energy, enthalpy, isothermal & adiabatic changes
- State function, effect of T&V on internal energy, effect of T&P on enthalpy, the relation between C_p & C_v
- Thermochemistry – measurement of the heat of reaction
- Hess law, Enthalpy of formation, enthalpy of combustion, bond energy, dependence of heat of reaction on temp
- 2nd & 3rd law of thermodynamic – spontaneous & non spontaneous
- Change, heat engine, Carnot cycle, formulation of 2nd law
- Entropy change for reversible and irreversible process, entropy of reaction, statistical consideration of entropy, 3rd law of thermodynamic
- Gibbs & Helmholtz free energy – criteria of chemical equilibrium, Helmholtz free energy (definition, effect of T&V on it)
- Gibbs free energy
- Maxwell relation, Open system

Chemical Equilibrium

- States of Matter, Physical Properties of Matter, Chemical Properties of Matter
- Phase, Gibbs Phase Rule, Water Phase Diagram
- Carbon Dioxide Phase Diagram, Sulphur Phase Diagram
- Two Components System (Binary Eutectic Phase Diagram)
- Liquid binary system mutual solubility
- Ternary Phase Diagram
- Chemical equilibrium (Determination of equilibrium constants)
- K_p and K_c for gaseous reaction and solution
- Le Chatelier's principle
- Ammonia equilibrium, Phosgene equilibrium
- Effect of inert gases on equilibrium
- The equilibrium constant for Heterogeneous reactions
- Solutions: definition and type of solution, Solubility and miscibility
- Ideal and non-ideal solutions
- Vapor pressure Composition Phase Diagram
- Raoult's Law
- Solution Separation
- Colligative Properties of solutions

Kinetic Chemistry

- Kinetic theory of gas
- The Theories of Reaction Rate Chemical kinetics
- Methods for determination of Order of reaction
- Factor affecting the reaction rate
- The Kinetics of Complex Reactions
- Collision theory
- Catalysts
- Photochemistry