# Chemistry Syllabus for 1st & 2nd year / A - Level

**Instructions:**
**The objective of "Champion of Subject" is to test the conceptual abilities of the students and candidates regarding the subject.**

- This is the comprehensive syllabus for the "Champion of Subject".
- Candidates are advised to thoroughly go through and study the syllabus
- The test will comprise of 120 MCQs.
- The time allowed for the test will be 120 min.
- MCQs will cover part or all the syllabus mentioned below.
- Munzill reserved the right to conduct an online or physical test.

## Chapter 1: Stoichiometry

**1.1: Mole**

**1.2: Representative Particles (Avogadro's Number))**

- Representative particles
- Avogadro's Number
- More on Avogadro's Number
- Stoichiometry
- Mole-Mass Calculations
- Calculating Moles from Mass
- Calculating Mass from Moles
- Calculating Mass in Grams and Moles
- Mole-Mass Calculations
- Mole-Particle Calculations
- More on Mole-Particle Calculations
- Calculating Mass in Grams of a Single Atom
- Calculating Number of Ions in the Compounds
- Calculating Number of Particles from Mass
- Calculating Mass and Moles of an Element from a Compound
- Molar Gas Volume
- Calculations of Molar Gas Volume

**1.3: Percentage Composition**

- The Empirical Formula from the Percentage Composition
- Calculating Percentage Composition

### 1.4: Excess and Limiting Reactants

- Limiting Reactants
- Importance of Limiting Reactants
- More on Importance of Limiting Reactants
- Calculating Limiting and Excess Reactants

### 1.5: Theoretical, Actual and Percent Yield

- Percentage Yield
- More on Yield
- Calculation of Percentage Yield

## Chapter 2: Atomic Structure

### 2.1: Discharge tube experiments

- Atom and its structure
- Discovery of Electron(Cathode rays)
- Properties of Cathode rays
- More on Properties of Cathode rays
- Discovery of Proton
- Properties of positive rays
- Discovery of Neutron
- Properties of Neutron
- Measurement of e/m Value of Electron
- Measurement of Charge on Electron-Millikan's Drop Method
- More on Measurement of Charge on Electron
- Mass of Electron
- Properties of Fundamental Particles
- Rutherford's Atomic Model
- Advantages and Defects in Rutherford's Atomic Model

### 2.2: Bohr's Atomic Model and its Applications

- Bohr's Atomic Theory
- Derivation of Radius of Revolving Electron in nth Orbit
- More on Derivation of Radius of Revolving Electron in nth Orbit
- The energy of Revolving Electron
- More on Energy of Revolving Electron
- The energy of Electron in nth Orbit
- Calculations of Frequency of Photons by Bohr's Theory

- Calculations of Wave Numbers of Photons by Bohr's Theory
- Defects of Bohr's Atomic Model
- More on Defects of Bohr's Atomic Model
- Hydrogen Spectrum
- More on Hydrogen Spectrum
- Calculation of Energy for Lithium-ion
- Lyman Series
- Balmer Series
- Paschen Series
- Brackett series
- Pfund series
- Calculation of Wave Number of Spectral series

**2.3: Plank's Quantum Theory**

- Planck's Quantum Theory
- More on Planck's Quantum Theory
- Conversion of Energy to Wavelength, Frequency and Wave Number

**2.4: X-rays**

- X-Rays
- Types of X-rays
- Study of X-Rays by Moseley
- Importance of Moseley's Law
- Uses of X-Rays

**2.5: The Quantum Numbers and Orbitals**

- Quantum Numbers
- Principal Quantum Numbers (n)
- Azimuthal Quantum Numbers (l)
- Magnetic Quantum Numbers (m)
- Spin Quantum Numbers (s)
- Quantum Numbers of Electrons
- Calculation of Combination of Quantum Numbers
- Shape of s-Orbitals
- Shapes of p-Orbitals
- Shapes of d-Orbitals

**2.6: Electronic Configurations**

- (n+l) Rule

- Aufbau Principle
- Pauli's Exclusion Principle and Hund's Rule
- Magnetic properties

## Chapter 3: Theories of Covalent Bonding and Shapes of Molecules

### 3.1: Shapes of Molecules

- Shapes of Molecule

### 3.2: Theories of Covalent Bonding

- Valence Shell Electron Pair Repulsion Theory
- Molecules Containing Two-Electron Pairs (AB2 Type) and AB3 Type
- AB2E and AB3 Type With Multiple Bonds
- AB4 Type With No Lone Pairs AB3E1 Type and AB2E2
- Molecules Containing Five Electron Pairs (AB5 Type)
- Molecules Containing Six Electron Pairs (AB6 Type)
- Valence Bond Theory
- More on Valence Bond Theory
- Formation of H2 Molecule
- Formation of Cl2 Molecule
- Formation of HF molecule
- Formation of O2 molecule
- Formation of N2 molecule
- Strength of Sigma and Pi Bonds
- Ground and the Excited State of Carbon
- Sp3 Hybridization
- More on Sp3 Hybridization
- Bonding and Structure of Ammonia
- Bonding and Structure of Water
- sp2-Hybridization; Bonding and Structure of Boron Trifluoride
- Sp2 Hybridization
- Sp Hybridization
- Bonding and Structure of Beryllium Dichloride
- Molecular Orbital Theory
- Head on approach and sideways Approach
- Relative Energies of the Molecular Orbitals
- MOT Diagramsfor O2 and F2
- MOT Diagrams for Be2, B2 and N2

- Molecular Orbital Structure of He2
- Molecular Orbital energy level Diagrams of Li2
- Comparison between VBT and MOT

**3.3: Bond Energy(Bond Enthalpy)**

- Bond Energy
- Ionic Character and Bond Energy
- More on Ionic Character and Bond Energy
- Bond Length
- More on Bond Length
- Dipole Moment
- Dipole Moments and Molecular Structure; Percentage Ionic Character

**3.4: Effect of Bonding on the Properties of Compounds**

- Metallic Solids
- Giant Molecules
- Energetics of Solution

## Chapter 4: Gases

**4.1: Kinetic Molecular Theory of Gases**

- Kinetic Molecular Theory of Gases
- More on Kinetic Molecular Theory of Gases
- The motion of Particles of a Gas

**4.2: Absolute Temperature scale on the Basis of Charle's Law**

- Charles's Law
- Experimental Verification of Charles's Law
- Explanation of Charle's Law from Kinetic Molecular Theory of Gases
- Units of Pressure
- Determining Pressure of a Gas
- Derivation of Absolute Zero
- Graphical Explanation of Charles' Law
- Kinetic Interpretation of Temperature
- Boyle's Law of Gases
- Experimental Verification of Boyle's Law
- Graphical Explanation of Boyle's Law

**4.3: Avogadro's Law**

- Avogadro's Law

**4.4: Ideal Gas Equation**

- General Gas Equation
- Ideal Gas Constant R
- Density of an Ideal Gas

**4.5: Deviation from Ideal Gas Behaviour**

- Causes for Deviations from Ideality

**4.6: Van der Waal's Equation**

- Van der Waals Equation for Real Gases; Volume Correction
- Pressure Correction

**4.7: Daltons Law of Partial Pressure and its Applications**

- Dalton's Law of Partial Pressures
- Applications of Dalton's Law of Partial Pressures

**4.8: Graham's Law of Diffusion and Effusion**

- Diffusion and Effusion in Gases
- Effect of Molecular Mass on the Rate of Diffusion
- Demonstration of Graham's Law

**4.9: Liquefaction of Gases**

- General Principle of Liquefaction
- Joule Thomson Effect
- Linde's Method of Liquefaction of Gases

**4.10: Fourth state of Matter - The Plasma**
**Plasma**

## Chapter 5: Liquids

**5.1: Kinetic Molecular Interpretation of Liquids**

- Postulates of Kinetic Molecular Theory of Liquids
- Shape and Volume of Liquids
- Compressibility and Ease of Flow of Liquids

- Evaporation in Liquids and its Uses
- Evaporation
- Dissolving, Filtering and Evaporating

**5.2: Intermolecular forces(Van der Waal's Forces)**

- Intermolecular Forces
- Dipole-Dipole Interactions
- Dipole-Induced Dipole Forces
- London Dispersion Forces
- Hydrogen Bonding in Paints, Dyes and Textile Materials
- Function of Soaps
- The solubility of Hydrogen-Bonded Molecules

**5.3: Physical properties of Liquids**

- Vapour Pressure
- Effect of Temperature on Vapour Pressure
- Boiling Point and External Pressure
- Boiling Points of Liquids
- Evaporation
- Viscosity
- Surface tension
- Anomalous Behaviour of Water
- More on Anamolous Behaviour of Water

**5.4: Energetics of Phase Changes**

- Molar Heat of Fusion
- Molar heat of Vaporisation
- Molar heat of Sublimation
- Energy Changes and Intermolecular Attractions
- Liquid Crystals

## Chapter 6: Solids

**6.1: Kinetic Molecular Interpretation of Solids**

- Kinetic Interpretation of Crystalline Solids
- Shape and Volume of Solids
- Compressibility and Ease of Flow of Solids
- Melting

- Rigidity and Melting point of Solids

**6.2: Types of Solids**

- Amorphous Solids
- Crystalline Solids
- Differences Between Amorphous and Crystalline Solids

**6.3: Properties of Crystalline Solids**

- Properties of Crystalline Solids
- Anisotropy
- Symmetry and Habit of a Crystal
- Isomorphism
- Polymorphism
- Transition Temperature
- Concept of Allotropy

**6.4: Crystal Lattice**

- Crystal Lattice
- Unit Cell
- Structure of Sodium Chloride
- Structure of Metals

**6.5: Properties of Different Types of Solids**

- Factors that affect the Shape of an ionic Solid
- Lattice Energy
- Comparison of Ionic and Covalent Crystals
- Low Density and High Heat of Fusion of Ice
- Metallic Solids
- Comparison of Molecular Crystals and Metallic Solids
- Hygroscopic Substances

## Chapter 7: Chemical Equilibrium

**7.1: Reversible Reaction and Dynamic Equilibrium**

- Reversible Chemical Reactions
- Dynamic Chemical Equilibrium
- Equilibrium Constant Kc and its Units
- Types of Equilibrium
- Determination of Equilibrium Constant by Physical Method

- Determination of Equilibrium Constant by Chemical Method
- Calculating the Equilibrium Constant for Reversible Reaction
- Calculate the Equilibrium Concentration
- Applications of Equilibrium Constants; Direction of Reaction
- Extent of Reaction
- Relationship Between Kp and Kx
- Relationship Between Kp and Kn
- Relationship Between Kc, Kp, Kx and Kn

**7.2: Factors Affecting Equilibrium**

- Le-Chatelier's Principle; Effect of Change in Concentration
- Effect of Change in Pressure or Volume
- Effect of Change in Temperature
- Effect of Catalyst on Equilibrium Constant

**7.3: Industrial Application of Le chatelier's Principle**

- The Haber's Process
- More on Haber process

**7.4: Solubility Product and Precipitation Reactions**

- Solubility Product

**7.5: Common Ion Effect**

- Common Ion Effect
- Some Examples of Common Ion Effect

## Chapter 8: Acids Bases and Salts

**8.1: Acidic, Basic and Amphoteric Substances**

- General Properties of Acids
- General Properties of Bases
- Amphoteric Compounds

**8.2: Bronsted-Lowry Concepts for Acids and Bases**

- Bronstead-Lowry Concept of Acids
- Bronstead-Lowry Concept of Bases

**8.3: Conjugate acid-Base Pairs**

- Conjugate Acid-Base Pairs

**8.4: Strength of Acids and Bases**

- Strength of Acids and Bases
- The Ion Product of Water
- pH, pOH and pKw
- Process of Titration
- Acid-Base Titration
- pKa and pKb
- Relationship between Ka and Kb

**8.5: Lewis Definition of Acid and Bases**

- Lewis Concept of Acids
- Lewis Concept of Bases

**8.6: Buffer Solution and their Applications**

- Buffer Solutions
- Buffer Action
- Calculation of pH of a Buffer
- More on Calculation of pH of a Buffer
- Buffer Capacity

**8.7: Salt Hydrolysis**

- Hydrolysis
- More on Hydrolysis
- Levelling Effect

## Chapter 9: Chemical Kinetics

**9.1: Chemical Kinetics**

- Introduction to Reaction Kinetics

**9.2: Rates of Reaction**

- Instantaneous and Average Rate
- Specific Rate Constant or Velocity Constant
- Order of Reaction
- Half-Life Period
- More on Effect of Concentration on Speed of Reaction
- Factors Affecting Rates Of Reactions, Nature of Reactants
- Effect of Concentration on Speed of Reaction

- Effect of Particle Size on Speed of Reaction
- Effect of Temperature on Speed of Reaction
- More on Effect of Temperature on Speed of Reaction
- Arrhenius Equation
- Rate Determining Step

## 9.3: Collision Theory, Transition State and Activation Energy

- Activation Energy
- More on Activation Energy
- Energy profile Diagram for Exothermic Reactions
- Energy profile Diagram for Endothermic Reactions
- The energy of Activation and Transition State Theory
- More on Energy of Activation and Transition State Theory

### 9.4: Catalysis

- Catalysts
- Types of Catalysis, Homogeneous and Heterogeneous Catalysis
- Characteristics of Catalyst
- Activation of Catalyst, Negative Catalyst and Autocatalyst
- Enzymes

# Chapter 10: Solutions and Colloids

### 10.1: General Properties of Solutions

- Hydrophilic and Hydrophobic Molecules
- Types of Solutions on the Basis of Physical States
- Solutions of Solids in Liquids
- Solutions of Completely Miscible and Practically Immiscible Liquids
- Partially Miscible Liquids
- Phenol-Water System
- Hydration Energy of Ions
- Hydration
- Hydrolysis
- More on Hydrolysis
- Energetics of Solution
- Water of Hydration
- Introduction to Solubility
- Solubility and Solute-Solvent Interactions

- The Effect of Temperature
- The Effect of Pressure

**10.2: Concentration Units**

- Percentage Mass/Mass
- Percentage Mass/Volume
- Percentage Volume/Mass
- Percentage Volume/Volume
- Determining Molarity from Percentage by Mass of Solution
- Molarity and Preparation of Molar Solution
- Molality
- Mole Fraction
- Interconversion of Various Concentration Units of Solutions
- More on Interconversion of Various Concentration Units of Solutions

**10.3: Raoult's Law**

- Raoult's Law
- Raoult's Law When Both Components are Volatile
- More on Raoult's Law When Both Components are Volatile

**10.4: Colligative Properties of Solutions Containing Non-Electrolyte Solutes**

- Lowering of Vapour Pressure
- Causes of Boiling Point Elevation and Freezing Point Depression
- Elevation of Boiling Point
- More on Elevation of Boiling Point
- Measurement of Boiling Point Elevation
- Depression of Freezing Point of a Solvent by a Solute
- Measurement of Freezing Point Depression
- Applications of Boiling Point Elevation and Freezing Point Depression
- Osmosis and Osmotic Pressure
- Reverse Osmosis

**10.5: Colloids**

- Colloids
- Properties of Colloids
- More on Properties of Colloids
- Types of Colloids
- Comparison of Solution, Suspension and Colloid

# Chapter 11: Thermochemistry

**11.1: Energy in Chemical Reactions**

- System and Surroundings
- Properties of the System and State Function
- work and Heat
- Exothermic Reactions
- Endothermic Reactions
- Some Examples of Endothermic and Exothermic Reactions
- Enthalpy

**11.2: Thermodynamics**

- Introduction to Thermochemistry

**11.3: Internal Energy**

- Internal Energy and Heat

**11.4: First Law of Thermodynamics**

- First Law of Thermodynamics

**11.5: Standard States and Standard Enthalpy Changes**

- Condition for Standard Heat of Reaction
- Enthalpy of Formation
- Enthalpy of Combustion
- Enthalpy of Atomization
- Enthalpy of Neutralization
- Bond Dissociation Energy

**11.6: Heat Capacity**

- Heat Capacity

**11.7: Calorimetry**

- Calorimetry
- Estimation of Heat of Reaction from Experimental Data
- Estimation of Energy Available from Food(Bomb Calorimeter)

**11.8: Hess's Law**

- Hess's Law of Constant Heat Summation

- Verification of Hess's Law

**11.9: Born-Haber Cycle**

- The Born-Haber Cycle

## Chapter 12: Electrochemistry

**12.1: Oxidation-Reduction Concepts**

- Introduction to Electrochemistry
- Oxidation and Reduction Reactions
- Oxidation State
- More on Oxidation State
- Finding out the Oxidation Numbers
- Identifying Substances Which are Oxidized or Reduced
- Identifying Oxidizing and Reducing Agents from the Reactions
- Balancing of Redox Equations by Oxidation Number Method
- More on Balancing of Redox Equations by Oxidation Number Method
- Balancing Equation Using Oxidation Number Method
- Balancing of Redox Equations by Ion-Electron Method
- Balancing of Redox Equations in Acidic Medium by Ion-Electron Method

**12.2: Electrode, Electrode Potential and Electrochemical Series**

- Galvanic Cell and its construction
- Working of the Cell
- Electrode Potential
- Standard Hydrogen Electrode
- Measurement of Electrode Potential
- Electrochemical Series
- The Reactivity Series of Metals
- Prediction of Feasibility of a Chemical Reaction
- Calculation of the Voltage or emf of Cells
- Metals and Non-metals as Reducing and Oxidising Agents
- Relative Chemical Reactivity of Metals
- The reaction of Metals with Dilute Acids
- Displacement of One Metal by Another from its Solution
- 12.3: Types of Electro-Chemical Cells (Practice Test)
- Electrolytic Cells
- Construction of an Electrolytic Cell

- Working of Electrolytic cell
- Faraday's First Law of Electrolysis
- Faraday's Second Law of Electrolysis
- Calculating the Amount of Silver Deposited
- Calculations of Electrolysis of Molten NaCl
- Dry Cell
- Nickel Cadmium Cell
- Lead-Storage Battery
- Discharging of Lead Battery
- Charging of Lead Battery
- Fuel Cells
- More on Fuel Cells
- Rusting of Iron
- Prevention of Corrosion
- Electroplating
- Silver Plating

## Chapter 13: s- And p-Block Elements

### 13.1: Period 3 (Na to Ar)

- Trend of Atomic Size and Atomic Radius in Periodic Table
- Trends in Atomic Radius of 3rd Period Elements
- The trend of Ionization Energy in Periodic Table
- Trends in First Ionization Energy of 3rd Period
- Trends in Electronegativity of 3rd Period
- Effect of Temperature on Vapour Pressure
- Trends in Melting points and Boiling points of 3rd Period
- Reactions of 3rd Period Elements with Water
- Reactions of 3rd Period Elements with O2
- Reactions of 3rd Period Elements with Chlorine
- Physical Properties of Oxides of 3rd Period Elements
- more on Physical Properties of Oxides of 3rd Period Elements
- Acid-Base Behaviour of Oxides of 3rd Period Elements
- More on Acid-Base Behaviour of Oxides of 3rd Period Elements

### 13.2: Group 1 Elements (Alkali Metals)

- Trend of Melting, Boiling Points & Density in Group I
- Trends in Chemical Properties of Alkali Metals

- Effect of heat on Group I Hydrogen Carbonates
- Flame Tests of Alkali Metals

**13.3: Group 2 Elements (Alkaline Earth Metals)**

- Trends in Atomic Radius and First Ionization Energy of Group II Eleme
- Trends in Electronegativity, Melting & Boiling points of Group II Ele
- Trends in Chemical Properties of Alkaline-Earth Metals
- More on Trends in Chemical Properties of Alkaline-Earth Metals
- Properties of Alkali and Alkaline Earth Metals Hydroxides
- Properties of Alkali and Alkaline Earth Metals Carbonates
- More on Properties of Alkali and Alkaline Earth Metals Carbonates
- Properties of Alkali and Alkaline Earth Metals Nitrates
- Properties of Alkali and Alkaline Earth Metals Sulphates
- Peculiar Behaviour of Beryllium
- 13.4: Group 4 Elements (Carbon Family) (Practice Test)
- Inert pair Effect in Formation of Ionic Bond
- The reaction of Group-IV A Elements Chlorides with water
- Group-IV A Elements Oxides
- Physical Properties of Carbon dioxide
- Physical Properties of Carbon monoxide
- Properties of Silica

**13.5: Group 7 Elements (Halogens)**

- Occurrence of Halogens
- Bond Enthalpies in Halogens
- Bond Enthalpies in Hydrogen Halides
- Relative Reactivities of the Halogens as Oxidizing Agents
- More on Relative Reactivities of the Halogens as Oxidizing Agents
- Halide Ions as Reducing agents

## Chapter 14: d- and f- Block Elements (Transition Elements)

**14.1: General Features**

- Introduction to the Transition Elements
- Binding Energies of Transition Elements
- More on Binding Energies of Transition Elements
- Oxidation State of Transition Elements
- Catalytic Properties of Transition elements
- Paramagnetism of Transition Elements

- More Characteristics of Transition Elements

**14.2: Coordination Compounds**

- Components of Complex Compounds
- More on Components of Complex Compounds
- Nomenclature of Complex Compounds
- More on Nomenclature of Complex Compounds
- Geometry of Complexes

**14.3: Chemistry of Some Important Transition Elements**

- Oxidation states of Vanadium
- Vanadium as Catalyst in Contact Process
- Oxidation states of Chromium
- Properties of Potassium Chromate
- Properties of Potassium Dichromate
- More on Properties of Potassium Dichromate
- Oxidation states of Manganese
- Properties of Potassium Permanganate
- More on Properties of Potassium Permanganate
- Oxidation states of Iron
- Iron as Catalyst in Haber's Process
- Iron ion in the Reaction between Persulphate ions and iodide ions
- Reaction of Hexaaqua iron (II) and Hexaaqua Iron (III)
- Reaction of the Iron ions with Carbonate and thiocyanate ions
- Oxidation states of Copper
- Reactions of Hexaaqua Copper (II) ions

## Chapter 15: Organic Compounds

**15.1: Sources**

- Features of Organic Compounds
- More on Features of Organic Compounds
- Coal
- Natural Gas
- Petroleum
- Plants and Natural Products Chemistry
- Partial and Total Synthesis

**15.2: Coal as a source of Organic Compounds**

- More on Destructive Distillation of Coal
- Conversion of Coal to Petroleum

**15.3: Characteristics of Organic Compounds**

- Features of Organic Compounds
- More on Features of Organic Compounds

**15.4: Uses of Organic Compounds**

- Importance of Organic Chemistry

**15.5: New Allotrope of Carbon: Bucky Ball**

- Bucky Balls

**15.6: Functional groups and Homologous Series**

- Functional Groups
- More on Functional Groups
- Classification of Organic Compound
- Types of Acylic Compounds
- Types of Cylic Compounds

**15.7: Detection of Elements in Organic Compounds**

- Detection of Elements in Organic Compounds
- More on Detection of Elements in Organic Compounds

## Chapter 16: Hydrocarbons

**16.1: Types of Hydrocarbons**

- Introduction to Hydrocarbons

**16.2: Alkanes and Cycloalkanes**

- Common and IUPAC names
- Nomenclature of Alkyl Groups
- Nomenclature of Alkanes
- More on Nomenclature of Alkanes
- Nomenclature of Alkenes
- Nomenclature of Alkynes
- Nomenclature of Cycloalkanes
- Physical properties of Alkanes

- Sp3 Hybridization
- More on Sp3 Hybridization
- Reactivity of Alkanes
- Reactivity of Cycloalkanes

**16.3: Radical Substitution Reactions**

- Homolytic and Heterolytic Fission
- Halogenation of Alkanes
- More on Halogenation of Alkanes

**16.4: Oxidation of Organic Compounds**

- Combustion of Alkanes

**16.5: Alkenes**

- Nomenclature of Alkenes
- Sp2 Hybridization
- Dehydrohalogenation of Alkyl Halides
- Dehydration of Alcohols
- More on Dehydration of Alcohols
- Addition of Hydrogen in Alkene
- More on Addition of Hydrogen in Alkene
- Addition of Hydrogen Halides in Alkene
- More on Addition of Hydrogen Halides in Alkene
- Addition of Sulphuric Acid in Alkene
- Addition of Halogens in Alkene
- Addition of Hypohalous Acid (HOX) in Alkene
- Addition of Oxygen in Alkene
- Ozonolysis of Alkene
- More on Ozonolysis of Alkene
- Polymerisation of Alkenes
- Conjugation in Alkene

**16.6: Isomerism**

- Optical Activity
- Optical Isomerism
- Optical Isomerism in Tartaric Acid
- Isomerism
- Structural Isomerism
- Position Isomerism

- Functional group Isomerism
- Metamerism
- Tautomerism
- Cis-trans Isomerism or Geometrical Isomerism
- Geometrical Isomerism in Cyclic compounds

**16.7: Alkynes**

- Nomenclature of Alkynes
- Reactivity of Alkynes
- Sp Hybridization
- Physical properties of Alkynes
- Dehydrohalogenation of Vicinal Dihalides
- Dehalogenation of Tetrahalides
- Acidic Nature of Alkynes
- Hydrogenation of Ethyne
- Addition of Halogen Acids in Alkynes
- Addition of Water in Alkynes
- Addition of Halogens in Alkynes
- Ozonolysis of Alkynes

**16.8: Benzene and Substituted Benzene**

- Nomenclature of Monosubstituted Benzene
- Nomenclature of Disubstituted Benzene
- Physical Properties of Benzene
- Structure of Benzene
- Benzene,Molecular Formula
- X-Ray Studies of benzene Structure
- The Stability of Benzene
- Resonance
- Reactivity of Benzene Towards Electrophiles
- Halogenation of Benzene
- Halogenation of Alkyl benzene
- Nitration of Benzene
- Sulphonation of Benzene
- Friedel-Crafts Reaction, Alkylation
- Friedel-Crafts Reaction, Acylation
- Reduction of Benzene
- Halogenation of Benzene in the Presence of Light
- Combustion of Benzene

- Catalytic Oxidation of Benzene
- Ozonolysis of Benzene
- ortho and para Directing Groups
- Meta-Directing Groups
- Relative Stability of Arenium Ion
- More on ortho and para Directing Groups
- Making Polysubstituted Benzenes

## Chapter 17: Alkyl Halides

**17.1: Alkyl Halides**

- Introduction to Alkyl Halides
- Nomenclature of Alkyl Halides
- Preparation of Alkyl Halides From Alcohols
- Structure of Alkyl Halides
- Reactivity of Alkyl Halides
- Nucleophilic Substitution Reactions
- Nucleophilic Substitution Bimolecular(SN2)
- Nucleophilic Substitution Unimolecular(SN1)
- ?-Elimination Reactions
- E1 Mechanism
- E2 Mechanism
- Wurtz Reaction
- Reduction of Alkyl Halides
- The reaction of Alkyl halide with Sodium Lead Alloy(Na4Pb)

**17.2: Organometallic Compounds**

- Preparation of Grignard Reagent
- Reactivity of Grignard Reagent
- Reactions of Grignard Reagent with CNCl, Alcohols and CO2
- Reactions of Grignard Reagent with Methanal and Ethanal
- Reactions of Grignard Reagent with Propanone and Epoxide
- The reaction of Grignard Reagent with Esters

**17.3: Amines**

- Amines and its Nomenclature
- Preparation of Amines
- The reaction of Amines with Aldehydes and Ketones
- Preparation of Diazonium Salts

# Chapter 18: Alcohols, Phenols and Ethers

## 18.1: Alcohols

- Introduction to Alcohols, Phenols and Ethers
- Classification of Alcohols
- Nomenclature of Alcohols
- Structure and Acidity of Alcohol
- Hydrolysis of Alkyl Halides
- The reaction of RMgX with Aldehyde and Ketone
- Reactions of Grignard Reagent with Propanone and Epoxide
- Catalytic Reduction of Aldehyde and Ketone
- Reduction of Carboxylic Acids and Esters
- Lucas Test
- Reactions of Alcohols in which C-O Bond is Broken
- Oxidative Cleavage of 1,2 Diols(Glycols)
- The Sulphur Analogues(Thiols RSH)

## 18.2: Phenols

- Nomenclature of Phenols
- Structure of Phenols
- Acidic Behaviour of Phenol
- Reactions of Phenol Due to -OH Group
- Preparation of Phenol
- Preparation of Phenol from Air Oxidation of Cumene
- Preparation of Phenol from Hydrolysis of Aryl Diazonium Salts
- Reactivity of Phenol
- Halogenation & Hydrogenation of Phenol
- Nitration of Phenol
- Oxidation of Phenol
- Difference Between Alcohol and Phenol

## 18.3: Ethers

- Nomenclature of Ethers
- Preparation of Ethers
- The mechanism for Alcohol Condensation to Give an Ether
- Chemical Reactivity of Ethers
- The reaction of Ethers with Halogen Acids and Acetyl Chloride

# Chapter 19: Aldehydes and Ketones

**19.1: Nomenclature**

- Nomenclature of Aldehydes
- Nomenclature of Ketones

**19.2: Physical Properties**

- Introduction to Aldehydes and Ketones

**19.3: Structure**

- Structure of the Carbonyl Group

**19.4: Preparation of Aldehydes and Ketones**

- Ozonolysis of Alkene
- Addition of Water in Alkynes
- More on Addition of Water in Alkynes
- More on Oxidation of Alcohols
- Friedel-Crafts Reaction, Acylation

**19.5: Reactivity of Carbonyl Group**

- Reactivity of Carbonyl Group

**19.6: Reactions of Aldehydes and Ketones**

- Aldol Condensation
- Cannizaro's Reaction
- Reactions of Carbonyl compounds with Hydroxylamine
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- Nomenclature of Carboxylic Acids

**20.2: Physical Properties**

- Physical Properties of Carboxylic Acids

**20.3: Structure**

- Structure of Carboxylic acid

**20.4: Acidity**

- The acidity of Carboxylic acid

**20.5: Preparation of Carboxylic Acids**

- Preparation of Carboxylic Acids from Grignard Reagents
- Preparation of Carboxylic Acids from Nitriles
- Preparation of Carboxylic Acids by Hydrolysis of Esters
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**20.6: Reactivity**

- Reactivity of Carboxyl Group

**20.7: Reactions of Carboxylic Acids**

- Formation of Acid Anhydride
- Reduction of Carboxylic Acids and Esters
- Friedel-Crafts Reaction, Acylation
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**21.1: Carbohydrates**

- Carbohydrates
- Classification of Carbohydrates, Monosaccharides
- Disaccharides
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**21.2: Proteins**

- Protein
- Classification of Proteins

**21.3: Enzymes**

- Enzymes
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- Lipids
- Sources of Lipids
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**21.5: Nucleic acids**

- Nucleic Acids

**21.6: Minerals of Biological Significance**

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**22.1: Introduction to the Chemical Industry**

- Introduction to Chemical Industries

**22.2: Safety Consideration in the Process of Industries**

- Safety Consideration in the Process Industries

**22.3: Pesticides**

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**22.8: Adhesives**

- Adhesives

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**23.1: Chemistry of Troposphere**

- Carbon Monoxide as Pollutant
- Smog as Pollutant
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- Depletion of Ozone
- Ozone Depletion due to Oxides of Nitrogen and Sulphur
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**23.2: Chemistry of the Stratosphere**

- Stratosphere
- Depletion of Ozone

**23.3: Water Pollution and Water Treatment**

- Detergents as Pollutant
- Water pollutants, Oxygen-Demanding Or Industrial Effluents
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**23.4: Green Chemistry**

- Green Chemistry and its Goals

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**24.1: Classical Methods of Analysis, Combustion Analysis:**

- The Percentage Composition of Elements in a Molecule
- The Percentage Composition of Sodium Carbonate crystal
- Empirical formula
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**24.2: Modern methods of Analysis:**

- Instrumental Methods of Analysis

- Electromagnetic Spectrum
- Infrared (IR) Spectroscopy
- More on Infrared (IR) Spectroscopy
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- More on Ultraviolet and Visible Spectrophotometry
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