

# Chemistry Syllabus for 9th & 10th / O - Level

## Chapter 1: Fundamentals of Chemistry

### 1.1: Branches of Chemistry

- History of Chemistry
- Chemistry
- Physical Chemistry
- Organic and Inorganic Chemistry
- Analytical Chemistry and Biochemistry
- Industrial and Nuclear Chemistry
- Environmental Chemistry and Polymeric Chemistry

### 1.2: Basic Definitions

- Element
- Compound
- Mixture
- Atomic Number and Mass Number
- Relative atomic mass and Atomic mass unit
- Calculating the Average Atomic Mass
- Empirical formula
- Empirical formula-covalent and ionic compound
- Molecular formula
- Molecular mass
- Formula mass
- Determining Molar Mass and Empirical Formula of Compounds

### 1.3: Chemical Species

- Ions, cation-anion
- Molecular Ion
- Free radical
- Types of molecules

### 1.4: Avogadro's Number and Mole

- Avogadro's Number
- Mole
- Gram Atomic mass, Gram molecular mass, Gram formula mass

- Calculating Moles from Mass
- Calculating Mass from Moles
- Calculating Mass in Grams and Moles

### **1.5: Chemical Calculations**

- 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

## **Chapter 2: Structure of Atoms**

### **2.1: Theories and Experiments Related to Atomic Structure**

- Rutherford's Atomic Model
- Common States of Matter(solid, liq,gas,plasma)
- Advantages and Defects in Rutherford's Atomic Model
- Interconversion of Three States of Matter
- Bohr's Atomic Theory
- Diffusion and Effusion in Gases
- Pressure and Standard Atmospheric Pressure
- Compressibility, Mobility and Density of Gases
- Experimental Verification of Boyle's Law
- Experimental Verification of Charles's Law

### **2.2: Isotopes**

- Isotopes
- Boyle's Law of Gases
- Isotopes of Carbon, Chlorine and Uranium
- Charles's Law
- Uses of Isotopes

### **2.3: Electronic Configuration**

- Electronic configuration
- Evaporation in Liquids and its Uses
- More on Electronic configuration
- Vapour Pressure

- Give Name and Symbol for the Elements
- Boiling Points of Liquids
- Electronic Configuration of Different Species
- Effect of Vapour Pressure on Boiling Point

#### **2.4: Typical Properties of Solid State**

- Rigidity and Melting point of Solids
- Sublimation of solids
- Density in Solids

#### **2.5: Types of Solids**

- Crystalline Solids
- Amorphous Solids

#### **2.6: Allotropes**

- Concept of Allotropy

#### **2.7: Comparison of Physical States of Matter**

- Comparison of Physical States of Matter

## **Chapter 3: Periodic Table and Periodicity of Properties**

### **3.1: Periodic Table**

- Introduction to Periodic Law And Periodic Table
- Modern Periodic Table
- Groups in Modern Periodic Table
- Periods in Modern Periodic Table
- 3.2: Periodicity of Properties
- Shielding Effect
- The trend of Shielding Effect in Periodic Table
- Atomic Size and Atomic Radius
- Trend of Atomic Size and Atomic Radius in Periodic Table
- Ionization Energy
- Trend of Ionization Energy in Periodic Table
- Electron Affinity
- Trend of Electron Affinity in Periodic Table
- Electronegativity
- Trend of Electronegativity in Periodic Table

## **Chapter 4: Structure of Molecules**

### **4.1: Why do Atoms React?**

- Why Do Atoms Form Chemical Bond?

### **4.2: Chemical Bonds**

- Chemical Bond

### **4.3: Types of Bonds**

- Ionic Bond
- Covalent Bond
- Types of Covalent Bonds
- Single Covalent Bond
- Double Covalent Bond
- Triple Covalent Bond
- Classify Bonds as Ionic or Covalent
- Drawing Lewis Dot and Cross Structures

### **4.4: Intermolecular Forces**

- Intermolecular Forces
- Dipole-Dipole Interactions
- Hydrogen Bonding

### **4.5: Nature of Bonding and Properties**

- Properties of Ionic Compound

## **Chapter 5: Physical States of Matter**

### **5.1: Typical Properties of Gaseous State**

- Common States of Matter(solid, liquid, gas, plasma)
- Interconversion of Three States of Matter
- Diffusion and Effusion in Gases
- Pressure and Standard Atmospheric Pressure
- Compressibility, Mobility and Density of Gases
- Experimental Verification of Boyle's Law
- Experimental Verification of Charles's Law

## **5.2: Laws Related to Gases**

- Boyle's Law of Gases
- Charles's Law

## **5.3: Typical Properties of Liquid State**

- Evaporation in Liquids and its Uses
- Vapour Pressure
- Boiling Points of Liquids
- Effect of Vapour Pressure on Boiling Point

## **5.4: Typical Properties of Solid State**

- Rigidity and Melting point of Solids
- Sublimation of solids
- Density in Solids

## **5.5: Types of Solids**

- Crystalline Solids
- Amorphous Solids

## **5.6: Allotropes**

- Concept of Allotropy

## **5.7: Comparison of Physical States of Matter**

- Comparison of Physical States of Matter

# **Chapter 6: Solutions**

## **6.1: Solution, Aqueous Solution, Solute and Solvent**

- Introduction to Solutions

## **6.2: Types of Solutions on the Basis of Concentration**

- Types of Solutions on the Basis of Concentration

## **6.3: Types of Solutions on the Basis of Physical States**

- Types of Solutions on the Basis of Physical States

## **6.4: Concentration Units**

- Percentage Mass/Mass
- Percentage Mass/Volume
- Percentage Volume/Mass
- Percentage Volume/Volume
- Molarity and Preparation of Molar Solution
- Determining Molarity from Percentage by Mass of Solution

### **6.5: Solubility**

- Introduction to Solubility
- Solubility and Solute-Solvent Interactions
- The Effect of Temperature
- Solubility and Nature of Solute
- Solubility and Nature of Solvent

### **6.6: Comparison of Solution, Suspension and Colloids**

- Comparison of Solution, Suspension and Colloid
- Calculating Molarity of a Solution
- Calculating Molality of a Solution
- Calculations of Dilution of Solution
- Calculation of Volume from Neutralisation Reactions

## **Chapter 7: Electrochemistry**

### **7.1: Oxidation and Reduction**

- Introduction to Electrochemistry
- Oxidation and Reduction in Terms of Loss and Gain of Electron
- Oxidation and Reduction in Terms of Loss and Gain of Oxygen
- Oxidation and Reduction in Terms of Loss and Gain of Hydrogen

### **7.2: Oxidation States and Rules for Assigning Oxidations States**

- Oxidation State and Rules for Assigning Oxidation State
- Finding out the Oxidation Numbers

### **7.3: Oxidizing and Reducing Agents**

- Oxidizing and Reducing Agents

### **7.4: Oxidation-Reduction Reactions**

- Oxidation and Reduction Reactions
- Identifying Substances Which are Oxidized or Reduced
- Identifying Oxidizing and Reducing Agents from the Reactions

- Recovering Metals from Their Ores

### **7.5: Electrochemical Cells**

- Concepts of Electrolytes
- Electrolytic Cells
- Construction of an Electrolytic Cell
- Working of Electrolytic cell
- Galvanic Cell and its construction
- Working of the Cell
- Electrolysis of Sodium Chloride
- Dry Cell
- Uses of Electrolysis

### **7.6: Electrochemical Industries**

- Electrolysis of Sodium Chloride
- Manufacture of NaOH from Brine
- Electroplating of Copper
- Electroplating of Zinc
- Electroplating of Tin
- Chrome Plating

### **7.7: Corrosion and its Prevention**

- Rusting of Iron
- Prevention of Corrosion
- Corrosion of Aluminium

## **Chapter 8: Chemical Reactivity**

### **8.1: Metals**

- Metal and its Physical Properties
- Electropositive Character of Metals
- Physical Properties of Alkali and Alkaline Earth Metals
- Chemical Properties of Alkali and Alkaline Earth Metals
- Electropositivity and Ionization Energy
- Chemical Properties of Metals
- The inertness of Noble Metals

### **8.2: Non-Metals**

- Physical properties of Non-Metals
- Electronegative Character
- Comparison of Reactivity of the Halogens

## **Chapter 9: Chemical Equilibrium**

### **9.1: Reversible Reactions and Dynamic Equilibrium**

- Chemical reactions and its types
- Reversible Chemical Reactions
- Static Chemical Equilibrium
- Dynamic Chemical Equilibrium
- Conditions and Recognition of Chemical Equilibrium

### **9.2: Law of Mass Action and its Derivation**

- Concept of Law of mass action
- Derivation of Law of Mass Action
- More on the derivation of the law of mass action
- Conditions and Recognition of Chemical Equilibrium

### **9.3: Equilibrium Constant and its Units**

- Equilibrium Constant  $K_c$  and its Units

### **9.4: Importance of Equilibrium Constant**

- Importance of  $K_c$
- Calculating the Equilibrium Constant for Reversible Reaction
- Calculate the Equilibrium Concentration

## **Chapter 10: Acids, Bases and Salts**

### **10.1: Concepts of Acids and Bases**

- General Properties of Acids
- General Properties of Bases
- Arrhenius Concept of Acids
- Arrhenius Concept of Bases
- Limitations of Arrhenius Concept
- Bronstead-Lowry Concept of Acids
- Bronstead-Lowry Concept of Bases
- Limitations of Bronsted-Lowry Concept
- Lewis Concept of Acids



- Lewis Concept of Bases
- Identifying Bronsted Acids and Bases from the Reactions
- Identifying Lewis Acids and Bases from the Reactions
- Identifying Weak or Strong Acids or Bases

### **10.2: Self-Ionization of Water -The pH Scale**

- Dissociation of Water
- The Ion Product of Water
- More on Ion Product of Water
- Concept of pH Scale
- Measuring of pH by Universal Indicator
- Indicators
- Calculating pH
- Calculating pOH

### **10.3: Salts**

- Introduction to Salts
- Neutralization Reaction
- More on Neutralisation
- Types of salts, Normal or Neutral Salts
- Acidic Salts
- Basic Salts
- The reaction of Bases with Acids
- The reaction of Acids with Metal Oxides and Hydroxides
- The reaction of Acids with Metals
- The reaction of Acids with Carbonates and Bicarbonates
- Double Displacement Reactions

### **10.4: Uses of Salts**

- Uses of Salts

## **Chapter 11: Organic Chemistry**

### **11.1: Organic Compounds**

- Concept of Organic Chemistry
- Catenation
- Isomerism
- Strength of Covalent Bond of Carbon

- Multiple Bonding
- General Characteristics of Organic Compounds
- More on General Characteristic of Organic Compounds
- Structural Formula
- Condensed Formula
- Saturated Hydrocarbons
- Unsaturated Hydrocarbons
- Naming of Alkane

### **11.2: Sources of Organic Compounds**

- Sources of Organic Compounds
- Coal and Its Types
- Natural Gas
- Petroleum
- Synthesis in Laboratory

### **11.3: Uses of Organic Compounds**

- Uses of Organic Compounds

### **11.4: Alkane and Alkyl Radicals**

- Alkane and Alkyl Radicals
- Formation of Alkyl Radicals
- Classification of Organic Compound
- Types of Acyclic Compounds
- Types of Cyclic Compounds

### **11.5: Functional Groups**

- Functional Groups
- More on Functional Groups
- Halo Group
- Functional Groups, Alcoholic Group
- Ether Linkage
- Aldehydic Group
- Ketonic Group
- Carboxylic Group
- Functional Group Containing Carbon, Hydrogen and Nitrogen
- Double and Triple Bond
- Confirmation Test for Unsaturation

- Confirmation Test for Carboxylic Group
- Detection of Aldehydic Group
- Test for Ketonic Group
- Test for Amino Group

## **Chapter 12: Hydrocarbons**

### **12.1: Alkanes**

- Alkanes
- Preparation of Alkane
- More on Preparation of Alkane
- Physical properties of Alkanes
- Halogenations of Alkanes
- Combustion of Alkanes
- Uses of Methane and Ethane

### **12.2: Alkenes**

- Alkenes
- Preparation of Alkene
- More on Preparation of Alkene
- Physical properties of Alkenes
- Halogenations of Alkenes
- Oxidation of Alkenes

### **12.3: Alkynes**

- Alkynes
- Preparation of Alkynes
- More Preparation of Alkynes
- Physical properties of Alkynes
- Addition Reaction of Halogens
- Oxidation of Alkynes
- Uses of Acetylene
- Identifying Organic Compounds
- Convert Propyne to Propane
- Convert Ethanol to Ethyl Bromide
- Organic Reactions Completion

## **Chapter 13: Biochemistry**

### **13.1: Carbohydrates**

- Carbohydrates
- Classification of Carbohydrates, Monosaccharides
- Oligosaccharides
- Polysaccharides
- Sources of Carbohydrates
- Uses of Carbohydrates

### **13.2: Proteins**

- Protein
- Aminoacids as Building Block of Protein
- Sources of Protein
- Uses of Protein

### **13.3: Lipids**

- Lipids
- Fatty Acids
- Sources of Lipids
- Uses of Lipids

### **13.4: Nucleic Acids**

- Nucleic Acids
- Deoxyribonucleic Acid
- Ribonucleic Acids

### **13.5: Vitamins**

- Vitamins
- Fat-Soluble Vitamins
- Water-Soluble Vitamins
- Importance of Vitamins

## **Chapter 14: Environmental Chemistry I: Atmosphere**

### **14.1: Composition of Atmosphere**

- Introduction to Atmosphere
- Composition of Atmosphere

### **14.2: Layers of Atmosphere**

- Layers of Atmosphere
- Troposphere
- Stratosphere
- Mesosphere
- Thermosphere

#### **14.3: Air Pollutants**

- Pollutants
- Types of Pollutants, Oxides
- Pollutants of Sulphur Compound
- Pollutants of Nitro Compound
- Sources of Air Pollutants
- Green House Effect
- Global Warming
- Effect of Global Warming
- Acid Rain
- Effect of Acid Rain

#### **14.4: Ozone Depletion and its Effects**

- Depletion of Ozone
- Effect of Ozone Depletion

### **Chapter 15: Environmental Chemistry II: Water**

#### **15.1: Properties of Water**

- Introduction to Water
- Uses of Water
- Physical Properties of Water
- Composition of Water

#### **15.2: Water as a Solvent**

- Water as a Universal Solvent

#### **15.3: Soft and Hard Water**

- Soft, Hard and Heavy Water
- Causes of Hardness

#### **15.4: Types of Hardness of Water**

- Temporary Hardness
- Permanent Hardness

### **15.5: Methods of Removing Hardness**

- Removal of Temporary Hardness By Heating
- Removal of Temporary Hardness By Clarks Method
- Removal of Permanent Hardness by Washing Soda
- Removal of Permanent Hardness by Using Zeolite

### **15.6: Disadvantages of Water Hardness**

- Disadvantages of Hard Water

### **15.7: Water Pollution**

- Disease-Causing Wastes(Domestic Effluents)
- Water pollutants, Oxygen-Demanding Or Industrial Effluents
- 15.8: Waterborne Diseases (Practice Test)
- Waterborne Infectious Diseases
- More on Waterborne Infectious Diseases

## **Chapter 16: Chemical Industries**

### **16.1: Basic Metallurgical Operations**

- Introduction to Chemical Industries
- Mining of Minerals
- Concentration of Ore
- Roasting
- Smelting
- Bassemerization Or Reduction
- Refining

### **16.2: Solvay Process**

- Solvay Process of sodium carbonate
- Advantages of the Solvay process

### **16.3: Urea**

- Manufacture of Urea
- Importance of Urea

### **16.4: Petroleum Industry**

- Petroleum

- Fractional Distillation of petroleum and its Importance