**2026-27**
**Chemistry**
**CLASS XI**
**Theory One Paper**

**Time: 3 Hours** **Total Marks: 70**

| S. No | UNIT | Marks |
|---|---|---|
| 1 | Some Basic Concepts of Chemistry | 7 |
| 2 | Structure of Atom | 9 |
| 3 | Classification of Elements and Periodicity in Properties | 6 |
| 4 | Chemical Bonding and Molecular Structure | 7 |
| 5 | Chemical Thermodynamics | 9 |
| 6 | Equilibrium | 7 |
| 7 | Redox Reactions | 4 |
| 8 | Organic Chemistry: Some basic Principles and Techniques | 11 |
| 9 | Hydrocarbons | 10 |
| | **TOTAL** | **70** |

**Unit 1: Some Basic Concepts of Chemistry**

General Introduction: Importance and scope of Chemistry, Nature of matter, laws of chemical combination, Dalton's atomic theory: concept of elements, atoms and molecules, atomic and molecular masses, mole concept and molar mass, percentage composition, empirical and molecular formula, chemical reactions, stoichiometry and calculations based on stoichiometry.

**Unit 2: Structure of Atom**

Discovery of Electron, Proton and Neutron, atomic number, isotopes and isobars. Thomson's model and its limitations. Rutherford's model and its limitations, Bohr's model and its limitations, concept of shells and subshells, dual nature of matter and light, de Broglie's relationship, Heisenberg uncertainty principle, concept of orbitals, quantum numbers, shapes of s, p and d orbitals, rules for filling electrons in orbitals - Aufbau principle, Pauli's exclusion principle and Hund's rule, electronic configuration of atoms, stability of half-filled and completely filled orbitals.

**Unit 3: Classification of Elements and Periodicity in Properties**

Significance of classification, brief history of the development of periodic table, modern periodic law and the present form of periodic table, periodic trends in properties of elements -atomic radii, ionic radii, inert gas radii, Ionization enthalpy, electron gain enthalpy, electronegativity, valiancy, Nomenclature of elements with atomic number greater than 100.

**Unit 4: Chemical Bonding and Molecular Structure**

Valence electrons, ionic bond, covalent bond, bond parameters, Lewis structure, polar character of covalent bond, covalent character of ionic bond, valence bond theory, resonance, geometry of covalent molecules, VSEPR theory, concept of hybridization, involving s, p and d orbitals and shapes of some simple molecules, molecular orbital theory of homonuclear diatomic molecules (qualitative idea only), Hydrogen bond.

**Unit 5: Chemical Thermodynamics**

Concepts of System and types of systems, surroundings, work, heat, energy, extensive

and intensive properties, state functions.
First law of thermodynamics -internal energy and enthalpy, heat capacity and specific heat, measurement of ΔU and ΔH, Hess's law of constant heat summation, enthalpy of bond dissociation, combustion, formation, atomization, sublimation, phase transition, ionization, solution and dilution. Second law of Thermodynamics (brief introduction), Introduction of entropy as a state function, Gibb's energy change for spontaneous and non- spontaneous processes, criteria for equilibrium, Third law of thermodynamics (brief introduction).

**Unit 6: Equilibrium**

Equilibrium in physical and chemical processes, dynamic nature of equilibrium, law of mass action, equilibrium constant, factors affecting equilibrium – Le Chatelier's principle, ionic equilibrium- ionization of acids and bases, strong and weak electrolytes, degree of ionization, ionization of poly basic acids, acid strength, concept of pH, hydrolysis of salts (elementary idea), buffer solution, Henderson Equation, solubility product, common ion effect (with illustrative examples).

**Unit 7: Redox Reactions**

Concept of oxidation and reduction, redox reactions, oxidation number, balancing redox reactions, in terms of loss and gain of electrons and change in oxidation number, applications of redox reactions.

**Unit 8: Organic Chemistry – Some Basic Principles and Techniques**

General introduction, methods of purification, qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds. Electronic displacements in a covalent bond: inductive effect, electrometric effect, resonance and hyper conjugation. Homolytic and heterolytic fission of a covalent bond: free radicals, carbocations, carbanions, electrophiles and nucleophiles, types of organic reactions.

**Unit 9: Hydrocarbons**

Aliphatic Hydrocarbons

Alkanes - Nomenclature, isomerism, conformation (ethane only), physical properties, chemical reactions including free radical mechanism of halogenation, combustion and pyrolysis.

Alkenes - Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation, chemical reactions: addition of hydrogen, halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition.

Alkynes - Nomenclature, structure of triple bond (ethyne), physical properties, methods of preparation, chemical reactions: acidic character of alkynes, addition reaction of - hydrogen, halogens, hydrogen halides and water.

Aromatic Hydrocarbons

Introduction, IUPAC nomenclature, benzene: resonance, aromaticity, chemical properties: mechanism of electrophilic substitution. Nitration, sulphonation, halogenation, Friedel Craft's alkylation and acylation, directive influence of functional group in mono substituted benzene, carcinogenicity and toxicity

**Note:** The following topics are included in the syllabus but will not be assessed .

1. **s & p Block Elements**
   Electronic configuration, atomic & Ionic radii, Ionization Enthalpy, Hydration Enthalpy and general trends in physical and chemical properties of s and p block elements across the periods and down the groups; unique behavior of the first element in each group.
2. **The Gaseous State**
   Qualitative treatment of Gas laws, Ideal gas equation and deviations from it.

## PRACTICAL

| Evaluation Scheme for Examination | Marks |
|---|---|
| Volumetric Analysis | 06 |
| Salt Analysis | 06 |
| Content Based Experiment | 05 |
| Project Work | 04 |
| Class record and viva | 04 |
| Internal Assessment (Unit Test) | 05 |
| **Total** | **30** |

**PRACTICAL SYLLABUS**

**Micro-chemical methods are available for several of the practical experiments, wherever possible such techniques should be used.**

**A. Basic Laboratory Techniques**

1. Cutting glass tube and glass rod
2. Bending a glass tube
3. Drawing out a glass jet
4. Boring a cork

**B. Characterization and Purification of Chemical Substances**

1. Determination of melting point of an organic compound.
2. Determination of boiling point of an organic compound.
3. Crystallization of impure sample of any one of the following: Alum, Copper Sulphate, Benzoic Acid.

**C. Experiments based on pH**

1. Any one of the following experiments:
   - Determination of pH of some solutions obtained from fruit juices, solution of known and varied concentrations of acids, bases and salts using pH paper or universal indicator.
   - Comparing the pH of solutions of strong and weak acids of same concentration.
   - Study the pH change in the titration of a strong base using a universal indicator.
2. Study the pH change by common-ion in case of weak acids and weak bases.

**D. Chemical Equilibrium**

Any one of the following experiments:

- Study the shift in equilibrium between ferric ions and thiocyanate ions by increasing/decreasing the concentration of either of the ions.
- Study the shift in equilibrium between $[Co(H_2O)_6]2+$ and chloride ions by changing the concentration of either of the ions.

**E. Quantitative Estimation**

1. Using a mechanical balance/electronic balance.
2. Preparation of standard solution of Oxalic acid.
3. Determination of strength of a given solution of Sodium hydroxide by titrating it against standard solution of Oxalic acid.
4. Preparation of standard solution of Sodium carbonate.
5. Determination of strength of a given solution of hydrochloric acid by titrating it against standard Sodium Carbonate solution.

**F. Qualitative Analysis**

1. Determination of one anion and one cation in a given salt

**Cations:** $Pb^{2+}$,$Cu^{2+}$, $Al^{3+}$, $Fe^{3+}$,$Mn^{2+}$, $Ni^{2+}$, $Zn^{2+}$, $Co^{2+}$, $Ca^{2+}$, $Sr^{2+}$, $Ba^{2+}$, $Mg^{2+}$, $NH_4^+$

**Anions:** $CO_3^{2-}$, $SO_3^{2-}$, $NO_3^-$, $Cl^-$, $Br^-$, $I^-$, $SO_4^{2-}$, $PO_4^{3-}$, $CH_3COO^-$

**(Note: Insoluble salts excluded)**

2. Detection of -Nitrogen, Sulphur, Chlorine in organic compounds.

**PROJECTS**

Scientific investigations involving laboratory testing and collecting information from other sources.

**A few suggested Projects**

a) Checking the bacterial contamination in drinking water by testing sulphide ion
b) Study of the methods of purification of water
c) Testing the hardness, presence of Iron, Fluoride, Chloride, etc., depending upon the regional variation in drinking water and study of causes of presence of these ions above permissible limit (if any).

d) Investigation of the foaming capacity of different washing soaps and the effect of addition of Sodium carbonate on it
e) Study the acidity of different samples of tea leaves.
f) Determination of the rate of evaporation of different liquids
g) Study the effect of acids and bases on the tensile strength of fibers.
h) Study of acidity of fruit and vegetable juices.

***Note:*** *Any other investigatory project, which involves about 10 periods of work, can be chosen with the approval of the teacher.*

**Prescribed Books:**

1. Chemistry Part – I, Class-XI, Published by NCERT.
2. Chemistry Part – II, Class-XI, Published by NCERT.

**Links for NCERT textbooks:**

1. **https://ncert.nic.in/textbook.php?kech1=0-6**
2. **https://ncert.nic.in/textbook.php?kech2=0-3**
3. **https://ncert.nic.in/division/dek/pdf/Manual_01.pdf**

## COURSE STRUCTURE
## CLASS XII
## THEORY

**Time: 3 Hours** **Total Marks: 70**

| S. No. | Title | Marks |
|---|---|---|
| 1 | Solutions | 7 |
| 2 | Electrochemistry | 9 |
| 3 | Chemical Kinetics | 7 |
| 4 | d -and f -Block Elements | 7 |
| 5 | Coordination Compounds | 7 |
| 6 | Haloalkanes and Haloarenes | 6 |
| 7 | Alcohols, Phenols and Ethers | 6 |
| 8 | Aldehydes, Ketones and Carboxylic Acids | 8 |
| 9 | Amines | 6 |
| 10 | Biomolecules | 7 |
| | **Total** | **70** |

**Unit 1: Solutions**

Types of solutions, expression of concentration of solutions of solids in liquids, solubility of gases in liquids, solid solutions, Raoult's law, colligative properties - relative lowering of vapor pressure, elevation of boiling point, depression of freezing point, osmotic pressure, determination of molecular masses using colligative properties, abnormal molecular mass, Van't Hoff factor

**Unit 2: Electrochemistry**

Redox reactions, EMF of a cell, standard electrode potential, Nernst equation and its application to chemical cells, Relation between Gibbs energy change and EMF of a cell, conductance in electrolytic solutions, specific and molar conductivity, variations of conductivity with concentration, Kohlrausch's Law, electrolysis and law of electrolysis (elementary idea), dry cell-electrolytic cells and Galvanic cells, lead accumulator, fuel cells, corrosion.

**Unit 3: Chemical Kinetics**

Rate of a reaction (Average and instantaneous), factors affecting rate of reaction: concentration, temperature, catalyst; order and molecularity of a reaction, rate law and specific rate constant, integrated rate equations and half-life (only for zero and first order

reactions), concept of collision theory (elementary idea, no mathematical treatment), activation energy, Arrhenius equation.

**Unit 4: d and f Block Elements**

General introduction, electronic configuration, occurrence and characteristics of transition metals, general trends in properties of the first row transition metals – metallic character, ionization enthalpy, oxidation states, ionic radii, colour, catalytic property, magnetic properties, interstitial compounds, alloy formation, preparation and properties of $K_2Cr_2O_7$ and $KMnO_4$.

**Lanthanides -** Electronic configuration, oxidation states, chemical reactivity and lanthanide contraction and its consequences.

**Actinides -** Electronic configuration, oxidation states and comparison with lanthanides

**Unit 5: Coordination Compounds**

Coordination compounds - Introduction, ligands, coordination number, colour, magnetic properties and shapes, IUPAC nomenclature of mononuclear coordination compounds. Bonding, Werner's theory, VBT, and CFT; structure and stereoisomerism, importance of coordination compounds (in qualitative analysis, extraction of metals and biological system).

**Unit 6: Haloalkanes and Haloarenes**

**Haloalkanes:** Nomenclature, nature of C–X bond, physical and chemical properties, optical rotation mechanism of substitution reactions.

**Haloarenes:** Nature of C–X bond, substitution reactions (Directive influence of halogen in monosubstituted compounds only).

Uses and environmental effects of - dichloromethane, trichloromethane, tetrachloromethane, iodoform, freons, DDT.

**Unit 7: Alcohols, Phenols and Ethers**

**Alcohols:** Nomenclature, methods of preparation, physical and chemical properties (of primary alcohols only), identification of primary, secondary and tertiary alcohols, mechanism of dehydration, uses with special reference to methanol and ethanol.

**Phenols:** Nomenclature, methods of preparation, physical and chemical properties, acidic nature of phenol, electrophilic substitution reactions, uses of phenols.

**Ethers:** Nomenclature, methods of preparation, physical and chemical properties, uses

**Unit 8: Aldehydes, Ketones and Carboxylic Acids**

**Aldehydes and Ketones:** Nomenclature, nature of carbonyl group, methods of preparation, physical and chemical properties, mechanism of nucleophilic addition, reactivity of alpha hydrogen in aldehydes, uses.

**Carboxylic Acids:** Nomenclature, acidic nature, methods of preparation, physical and chemical properties; uses.

**Unit 9: Amines**

**Amines:** Nomenclature, classification, structure, methods of preparation, physical and chemical properties, uses, identification of primary, secondary and tertiary amines.

**Diazonium salts:** Preparation, chemical reactions and importance in synthetic organic chemistry.

**Unit 10: Biomolecules**

**Carbohydrates -** Classification (aldoses and ketoses), monosaccahrides (glucose and fructose), D-L configuration oligosaccharides (sucrose, lactose, maltose), polysaccharides (starch, cellulose, glycogen); Importance of carbohydrates.

**Proteins -**Elementary idea of - amino acids, peptide bond, polypeptides, proteins, structure of proteins - primary, secondary, tertiary structure and quaternary structures (qualitative idea only), denaturation of proteins; enzymes. Hormones - Elementary idea excluding structure.

**Vitamins -** Classification and functions.

**Nucleic Acids:** DNA and RNA.

## PRACTICAL

| Topic | Marks | |
|---|---|---|
| | Internal Examiner | External Examiner |
| Project work | 05 | - |
| Practical Record | 05 | - |
| Continuous assessment(Unit Test) | 05 | - |
| Volumetric analysis | - | 05 |
| Salt Analysis | - | 05 |
| Content Based Experiment | - | 03 |
| Viva voice | - | 02 |
| **Total** | **15** | **15** |

## PRACTICAL SYLLABUS

**Micro-chemical methods are available for several of the practical experiments, wherever possible such techniques should be used.**

### A. Surface Chemistry

1. Preparation of one lyophilic and one lyophobic sol
   Lyophilic sol - starch, egg albumin and gumLyophobic sol – aluminum hydroxide, ferric hydroxide, arsenous sulphide.
2. Dialysis of sol-prepared in (a) above.
3. Study of the role of emulsifying agents in stabilizing the emulsion of different oils.

### B. Chemical Kinetics

1. Effect of concentration and temperature on the rate of reaction between Sodium Thiosulphate and Hydrochloric acid.
2. Study of reaction rates of any one of the following:
   - Reaction of Iodide ion with Hydrogen Peroxide at room temperature using different concentration of Iodide ions.
   - Reaction between Potassium Iodate, ($KIO_3$) and Sodium Sulphate: ($Na_2SO_3$) using starch solution as indicator (clock reaction).

### C. Thermochemistry

Any one of the following experiments

- Enthalpy of dissolution of Copper Sulphate or Potassium Nitrate.
- Enthalpy of neutralization of strong acid (HCl) and strong base (NaOH).
- Determination of enthalpy change during interaction (Hydrogen bond formation) between Acetone and Chloroform.

### D. Electrochemistry

Variation of cell potential in $Zn/Zn^{2+}||\ Cu^{2+}/Cu$ with change in concentration of electrolytes ($CuSO_4$ or $ZnSO_4$) at room temperature.

### E. Chromatography

1. Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of Rf values.
2. Separation of constituents present in an inorganic mixture containing two cations only (constituents having large difference in Rf values to be provided).

### F. Preparation of Inorganic Compounds

1. Preparation of double salt of Ferrous Ammonium Sulphate or Potash Alum.
2. Preparation of Potassium Ferric Oxalate.

### G. Preparation of Organic Compounds

Preparation of any one of the following compounds

1. Acetanilide

2. Di -benzalAcetone
3. p-Nitroacetanilide
4. Aniline yellow or 2 - Naphthol Aniline dye.

**H. Tests for the functional groups present in organic compounds**

Unsaturation, alcoholic, phenolic, aldehydic, ketonic, carboxylic and amino (Primary) groups.

**I. Characteristic tests of carbohydrates, fats and proteins in pure samples and their detection in given foodstuffs.**

**J. Determination of concentration/ molarity of KMnO4 solution by titrating it against a standard solution of:**

1. Oxalic acid,
2. Ferrous Ammonium Sulphate

(Students will be required to prepare standard solutions by weighing themselves).

**K. Qualitative analysis**

**M. Determination of one cation and one anion in a given salt.**

**Cation :** $Pb^{2+}$, $Cu^{2+}$ $As^{3+}$, $A\ell^{3+}$, $Fe^{3+}$, $Mn^{2+}$, $Zn^{2+}$, $Cu^{2+}$, $Ni^{2+}$, $Ca^{2+}$, $Sr^{2+}$, $Ba^{2+}$, $Mg^{2+}$, $NH_4^+$

**Anions:** $(CO_3)^{2-}$, $S^{2-}$, $(SO_3)^{2-}$, $(NO_2)^-$, $(SO_4)^{2-}$, $C\ell^-$, $Br^-$, $I^-$, $PO^{3-}{}_4$, $(C_2O_4)^{2-}$, $CH_3COO^-$,$NO_3^-$

**(Note: Insoluble salts excluded)**

**PROJECTS**

Scientific investigations involving laboratory testing and collecting information from other sources.

**A few suggested Projects**

a) Study of the presence of oxalate ions in guava fruit at different stages of ripening.
b) Study of quantity of casein present in different samples of milk.
c) Preparation of soybean milk and its comparison with the natural milk with respect to curd formation, effect of temperature, etc.
d) Study of the effect of Potassium Bisulphate as food preservative under various conditions (temperature, concentration, time, etc.)
e) Study of digestion of starch by salivary amylase and effect of pH and temperature on it.
f) Comparative study of the rate of fermentation of following materials: wheat flour, gram flour, potato juice, carrot juice, etc.
g) Extraction of essential oils present in Saunf (aniseed), Ajwain (carom), Illaichi (cardamom).
h) Study of common food adulterants in fat, oil, butter, sugar, turmeric power, chili powder and pepper.

***Note:*** *Any other investigatory project, can be chosen with the approval of the teacher.*