

**Syllabus 2020-21**  
**CLASS – XII**  
**Chemistry (Code No. 043)**

**COURSE STRUCTURE**

No.	Title	No. of Periods	Marks
I.	Solid State	10	23
II.	Solutions	10	
III.	Electrochemistry	12	
IV.	Chemical Kinetics	10	
V.	Surface Chemistry	08	
VI.	General Principles and Processes of Isolation of Elements	08	19
VII.	p-Block Elements	12	
VIII.	d-and f-Block Elements	12	
IX.	Coordination Compounds	12	
X.	Haloalkanes and Haloarenes	10	28
XI.	Alcohols, Phenols and Ethers	10	
XII.	Aldehydes, Ketones and Carboxylic Acids	10	
XIII.	Amines	10	
XIV.	Biomolecules	12	
XV.	Polymers	08	
XVI.	Chemistry in Everyday Life	06	
<b>Total</b>		<b>160</b>	<b>70</b>

**Unit I: Solid State**

**10 Periods**

Classification of solids based on different binding forces: molecular, ionic, covalent and metallic solids, amorphous and crystalline solids

(elementary idea). Unit cell in two dimensional and three dimensional lattices, calculation of density of unit cell, packing in solids, packing efficiency, voids, number of atoms per unit cell in a cubic unit cell, point defects, electrical and magnetic properties. Band theory of metals, conductors, semiconductors and insulators and  $n$  and  $p$  type semiconductors.

**Unit II: Solutions****10 Periods**

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 vapour 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 III: Electrochemistry****12 Periods**

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 IV: Chemical Kinetics****10 Periods**

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 V: Surface Chemistry****08 Periods**

Adsorption - physisorption and chemisorption, factors affecting adsorption of gases on solids, catalysis: homogenous and heterogenous, activity and selectivity of solid catalysts; enzyme catalysis, colloidal state: distinction between true solutions, colloids and suspension; lyophilic, lyophobic, multi-molecular and macromolecular colloids; properties of colloids; Tyndall effect, Brownian movement, electrophoresis, coagulation, emulsion - types of emulsions.

**Unit VI: General Principles and Processes of Isolation of Elements****08 Periods**

Principles and methods of extraction - concentration, oxidation, reduction - electrolytic method and refining; occurrence and principles of extraction of aluminium, copper, zinc and iron.

**Unit VII: p-Block Elements****12 Periods**

**Group-15 Elements:** General introduction, electronic configuration, occurrence, oxidation states, trends in physical and chemical properties; Nitrogen preparation properties and uses; compounds of Nitrogen: preparation and properties of Ammonia and Nitric Acid, Oxides of Nitrogen (Structure only); Phosphorus - allotropic forms, compounds of Phosphorus: Preparation and properties of Phosphine, Halides and Oxoacids (elementary idea only).

**Group 16 Elements:** General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties, dioxygen: preparation, properties and uses, classification of Oxides, Ozone, Sulphur -allotropic forms; compounds of Sulphur: preparation properties and uses of Sulphur-dioxide, Sulphuric Acid: industrial process of manufacture, properties and uses; Oxoacids of Sulphur (Structures only).



**Group 17 Elements:** General introduction, electronic configuration, oxidation states, occurrence, trends in physical and chemical properties; compounds of halogens, Preparation, properties and uses of Chlorine and Hydrochloric acid, interhalogen compounds, Oxoacids of halogens (structures only).

**Group 18 Elements:** General introduction, electronic configuration, occurrence, trends in physical and chemical properties, uses.

### **Unit VIII: d and f Block Elements**

**12 Periods**

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  $KMnO_4$ .

**Lanthanoids** - Electronic configuration, oxidation states, chemical reactivity and lanthanoid contraction and its consequences.

**Actinoids** - Electronic configuration, oxidation states and comparison with lanthanoids.

### **Unit IX: Coordination Compounds**

**12 Periods**

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 X: Haloalkanes and Haloarenes. 10 Periods**

**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 XI: Alcohols, Phenols and Ethers 10 Periods**

**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 XII: Aldehydes, Ketones and Carboxylic Acids 10 Periods**

**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 XIII: Amines 10 Periods**

**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 XIV: Biomolecules 12 Periods**

**Carbohydrates** - Classification (aldoses and ketoses), monosaccharides (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.

**Unit XV: Polymers 08 Period**

Classification - natural and synthetic, methods of polymerization (addition and condensation), copolymerization, some important polymers: natural and synthetic like polythene, nylon polyesters, bakelite, rubber. Biodegradable and non-biodegradable polymers.

**Unit XVI: Chemistry in Everyday life 06 Periods**

**Chemicals in medicines** - analgesics, tranquilizers antiseptics, disinfectants, antimicrobials, antifertility drugs, antibiotics, antacids, antihistamines.

**Chemicals in food** - preservatives, artificial sweetening agents, elementary idea of antioxidants.

**Cleansing agents-** soaps and detergents, cleansing action.



**PRACTICALS**

<b>Evaluation Scheme for Examination</b>	<b>Marks</b>
Volumetric Analysis	08
Salt Analysis	08
Content Based Experiment	06
Project Work	04
Class record and viva	04
	<b>30</b>

**PRACTICAL SYLLABUS****Periods: 60**

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

**A. Surface Chemistry**

- (a) Preparation of one lyophilic and one lyophobic sol  
Lyophilic sol - starch, egg albumin and gum  
Lyophobic sol - aluminium hydroxide, ferric hydroxide, arsenous sulphide.
- (b) Dialysis of sol-prepared in (a) above.
- (c) Study of the role of emulsifying agents in stabilizing the emulsion of different oils.

**B. Chemical Kinetics**

- (a) Effect of concentration and temperature on the rate of reaction between Sodium Thiosulphate and Hydrochloric acid.
- (b) Study of reaction rates of any one of the following:
  - (i) Reaction of Iodide ion with Hydrogen Peroxide at room temperature using different concentration of Iodide ions.
  - (ii) Reaction between Potassium Iodate, ( $\text{KIO}_3$ ) and Sodium Sulphite: ( $\text{Na}_2\text{SO}_3$ ) using starch solution as indicator (clock reaction).

**C. Thermochemistry**

Any one of the following experiments

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

**D. Electrochemistry**

Variation of cell potential in  $\text{Zn}/\text{Zn}^{2+} \parallel \text{Cu}^{2+}/\text{Cu}$  with change in concentration of electrolytes ( $\text{CuSO}_4$  or  $\text{ZnSO}_4$ ) at room temperature.

**E. Chromatography**

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

**F. Preparation of Inorganic Compounds**

Preparation of double salt of Ferrous Ammonium Sulphate or Potash Alum.

Preparation of Potassium Ferric Oxalate.

**G. Preparation of Organic Compounds**

Preparation of any one of the following compounds

- i) Acetanilide
- ii) Di-benzalAcetone
- iii) p-Nitroacetanilide
- iv) Aniline yellow or 2 - Naphthol Anilinedye.

**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  $\text{KMnO}_4$  solution by titrating it against a standard solution of:**

- i) Oxalic acid,
  - ii) Ferrous Ammonium Sulphate
- (Students will be required to prepare standard solutions by weighing themselves).

**K. Qualitative analysis****Determination of one cation and one anion in a given salt.**

**Cation :**  $\text{Pb}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{As}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{NH}_4^+$

**Anions:**  $(\text{CO}_3)^{2-}$ ,  $\text{S}^{2-}$ ,  $(\text{SO}_3)^{2-}$ ,  $(\text{NO}_2)^-$ ,  $(\text{SO}_4)^{2-}$ ,  $\text{Cl}^-$ ,  $\text{Br}^-$ ,  $\text{I}^-$ ,  $\text{PO}_4^{3-}$ ,  $(\text{C}_2\text{O}_4)^{2-}$ ,  $\text{CH}_3\text{COO}^-$ ,  $\text{NO}_3^-$

(Note: Insoluble salts excluded)

**PROJECT**

**Scientific investigations involving laboratory testing and collecting information from other sources A few suggested Projects.**

- Study of the presence of oxalate ions in guava fruit at different stages of ripening.
- Study of quantity of casein present in different samples of milk.
- Preparation of soybean milk and its comparison with the natural milk with respect to curd formation, effect of temperature, etc.
- Study of the effect of Potassium Bisulphate as food preservative under various conditions (temperature, concentration, time, etc.)
- Study of digestion of starch by salivary amylase and effect of pH and temperature on it.
- Comparative study of the rate of fermentation of following materials: wheat flour, gram flour, potato juice, carrot juice, etc.

- Extraction of essential oils present in Saunf (aniseed), Ajwain (carum), Illaichi (cardamom).
- Study of common food adulterants in fat, oil, butter, sugar, turmeric power, chilli powder and pepper.

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

### **Practical Examination for Visually Impaired Students of Classes XII Evaluation Scheme**

**Time Allowed: Two hours**

**Max. Marks: 30**

Identification/Familiarity with the apparatus	5 marks
Written test (based on given/prescribed practicals)	10 marks
Practical Record	5 marks
Viva	10 marks
<b>Total</b>	<b>30 marks</b>

#### **General Guidelines**

- The practical examination will be of two hour duration.
- A separate list of ten experiments is included here.
- The written examination in practicals for these students will be conducted at the time of practical examination of all other students.
- The written test will be of 30 minutes duration.
- The question paper given to the students should be legibly typed. It should contain a total of 15 practical skill based very short answer type questions. A student would be required to answer any 10 questions.
- A writer may be allowed to such students as per CBSE examination rules.

- All questions included in the question papers should be related to the listed practicals. Every question should require about two minutes to be answered.
- These students are also required to maintain a practical file. A student is expected to record at least five of the listed experiments as per the specific instructions for each subject. These practicals should be duly checked and signed by the internal examiner.
- The format of writing any experiment in the practical file should include aim, apparatus required, simple theory, procedure, related practical skills, precautions etc.
- Questions may be generated jointly by the external/internal examiners and used for assessment.
- The viva questions may include questions based on basic theory/principle/concept, apparatus/materials/ chemicals required, procedure, precautions, sources of error etc.

**A. Items for Identification/Familiarity of the apparatus for assessment in practical (All experiments)**

Beaker, glass rod, tripod stand, wire gauze, Bunsen burner, What man filter paper, gas jar, capillary tube, pestle and mortar, test tubes, tongs, test tube holder, test tube stand, burette, pipette, conical flask, standard flask, clamp stand, funnel, filter paper

Hands-on Assessment

- Identification/familiarity with the apparatus
- Odour detection in qualitative analysis

**B. List of Practicals**

The experiments have been divided into two sections: Section A and Section B. The experiments mentioned in Section B are mandatory.



**SECTION- A****A Surface Chemistry**

- (1) Preparation of one lyophilic and one lyophobic sol  
Lyophilic sol - starch, egg albumin and gum
- (2) Preparation of one lyophobic sol  
Lyophobic sol – Ferric hydroxide

**B Chromatography**

- (1) Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of R<sub>f</sub> values (distance values may be provided).

**C Tests for the functional groups present in organic compounds:**

- (1) Alcoholic and Carboxylic groups.
- (2) Aldehydic and Ketonic

**D Characteristic tests of carbohydrates and proteins in the given foodstuffs.****E Preparation of Inorganic Compounds- Potash Alum****SECTION-B (Mandatory)****F Quantitative analysis**

- (1) (a) Preparation of the standard solution of Oxalic acid of a given volume  
(b) Determination of molarity of KMnO<sub>4</sub> solution by titrating it against a standard solution of Oxalic acid.
- (2) The above exercise [F 1 (a) and (b)] to be conducted using Ferrous ammonium sulphate (Mohr's salt)

**G Qualitative analysis:**

(1) Determination of one cation and one anion in a given salt. Cation  $\text{--NH}_4^+$

Anions –  $\text{CO}_3^{2-}$ ,  $\text{S}^{2-}$ ,  $\text{SO}_3^{2-}$ ,  $\text{Cl}^-$ ,  $\text{CH}_3\text{COO}^-$

(Note: Insoluble salts excluded)

**Note:** The above practicals may be carried out in an experiential manner rather than recording observations.

**Prescribed Books:**

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

**CHEMISTRY (Code No. 043)**  
**QUESTION PAPER DESIGN**  
**CLASSES - XII (2020-21)**

S	Domains	Total Marks	%
1	<b>Remembering and Understanding:</b> Exhibit memory of previously learned material by recalling facts, terms, basic concepts and answers. Demonstrate understanding of facts and ideas by organizing, comparing, translating, interpreting, giving descriptions and stating main ideas.	28	40
2	<b>Applying:</b> Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	21	30
3	<b>Analysing, Evaluating and Creating:</b> Examine and break information into parts by identifying motives or causes. Make inferences and find evidence to support generalizations. Present and defend opinions by making judgments about information, validity of ideas or quality of work based on a set of criteria. Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.	21	30