

8. CHEMISTRY (Code No. 043)

Rationale

Higher Secondary is the most crucial stage of school education because at this juncture specialized discipline based, content -oriented courses are introduced. Students reach this stage after 10 years of general education and opt for Chemistry with a purpose of pursuing their career in basic sciences or professional courses like medicine, engineering, technology and study courses in applied areas of science and technology at tertiary level. Therefore, there is a need to provide learners with sufficient conceptual background of Chemistry, which will make them competent to meet the challenges of academic and professional courses after the senior secondary stage.

The new and updated curriculum is based on disciplinary approach with rigour and depth taking care that the syllabus is not heavy and at the same time it is comparable to the international level. The knowledge related to the subject of Chemistry has undergone tremendous changes during the past one decade. Many new areas like synthetic materials, bio -molecules, natural resources, industrial chemistry are coming in a big way and deserve to be an integral part of chemistry syllabus at senior secondary stage. At international level, new formulations and nomenclature of elements and compounds, symbols and units of physical quantities floated by scientific bodies like IUPAC and CGPM are of immense importance and need to be incorporated in the updated syllabus. The revised syllabus takes care of all these aspects. Greater emphasis has been laid on use of new nomenclature, symbols and formulations, teaching of fundamental concepts, application of concepts in chemistry to industry/ technology, logical sequencing of units, removal of obsolete content and repetition, etc.

Objectives

The broad objectives of teaching Chemistry at Senior Secondary Stage are:

- to promote understanding of basic facts and concepts in chemistry while retaining the excitement of chemistry.
- to make students capable of studying chemistry in academic and professional courses (such as medicine, engineering, technology) at tertiary level.
- to expose the students to various emerging new areas of chemistry and apprise them with their relevance in future studies and their application in various spheres of chemical sciences and technology.
- to equip students to face various challenges related to health, nutrition, environment, population, weather, industries and agriculture.
- to develop problem solving skills in students.
- to expose the students to different processes used in industries and their technological applications.
- to apprise students with interface of chemistry with other disciplines of science such as physics, biology, geology, engineering etc.
- to acquaint students with different aspects of chemistry used in daily life.
- to develop an interest in students to study chemistry as a discipline.

COURSE STRUCTURE
CLASS-XI (THEORY) (2016-17)

Total Periods (Theory 160 + Practical 60)

Time: 3 Hours

Total Marks 70

| Unit No. | Title | No. of Periods | Marks |
|-----------|--|----------------|-----------|
| Unit I | Some Basic Concepts of Chemistry | 12 | 11 |
| Unit II | Structure of Atom | 14 | |
| Unit III | Classification of Elements and Periodicity in Properties | 08 | 04 |
| Unit IV | Chemical Bonding and Molecular Structure | 14 | 21 |
| Unit V | States of Matter: Gases and Liquids | 12 | |
| Unit VI | Chemical Thermodynamics | 16 | |
| Unit VII | Equilibrium | 14 | |
| Unit VIII | Redox Reactions | 06 | 16 |
| Unit IX | Hydrogen | 08 | |
| Unit X | s -Block Elements | 10 | |
| Unit XI | Some p -Block Elements | 14 | |
| Unit XII | Organic Chemistry: Some basic Principles and Techniques | 14 | 18 |
| Unit XIII | Hydrocarbons | 12 | |
| Unit XIV | Environmental Chemistry | 06 | |
| | Total | 160 | 70 |

Unit I: Some Basic Concepts of Chemistry **12 Periods**

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 II: Structure of Atom **14 Periods**

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 III: Classification of Elements and Periodicity in Properties **08 Periods**

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, valency. Nomenclature of elements with atomic number greater than 100.

Unit IV: Chemical Bonding and Molecular structure **14 Periods**

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 V: States of Matter: Gases and Liquids **12 Periods**

Three states of matter, intermolecular interactions, types of bonding, melting and boiling points, role of gas laws in elucidating the concept of the molecule, Boyle's law, Charles; law, Gay Lussac's law, Avogadro's law, ideal behaviour, empirical derivation of gas equation, Avogadro's number, ideal gas equation. Deviation from ideal behaviour, liquefaction of gases, critical temperature, kinetic energy and molecular speeds (elementary idea), Liquid State- vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations)

Unit VI: Chemical Thermodynamics **16 Periods**

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 VII: Equilibrium **14 Periods**

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, Henderson Equation, hydrolysis of salts (elementary idea), buffer solution, solubility product, common ion effect (with illustrative examples).

Unit VIII: Redox Reactions **06 Periods**

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 IX: Hydrogen **08 Periods**

Position of hydrogen in periodic table, occurrence, isotopes, preparation, properties and uses of hydrogen, hydrides-ionic, covalent and interstitial; physical and chemical properties of water,

heavy water, hydrogen peroxide -preparation, reactions and structure and use; hydrogen as a fuel.

Unit X: s-Block Elements (Alkali and Alkaline Earth Metals) 10 Periods

Group 1 and Group 2 Elements

General introduction, electronic configuration, occurrence, anomalous properties of the first element of each group, diagonal relationship, trends in the variation of properties (such as ionization enthalpy, atomic and ionic radii), trends in chemical reactivity with oxygen, water, hydrogen and halogens, uses.

Preparation and Properties of Some Important Compounds:

Sodium Carbonate, Sodium Chloride, Sodium Hydroxide and Sodium Hydrogencarbonate, Biological importance of Sodium and Potassium.

Calcium Oxide and Calcium Carbonate and their industrial uses, biological importance of Magnesium and Calcium.

Unit XI: Some p -Block Elements 14 Periods

General Introduction to p -Block Elements

Group 13 Elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous properties of first element of the group, Boron - physical and chemical properties, some important compounds, Borax, Boric acid, Boron Hydrides, Aluminium: Reactions with acids and alkalies, uses.

Group 14 Elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first elements. Carbon-catenation, allotropic forms, physical and chemical properties; uses of some important compounds: oxides. Important compounds of Silicon and a few uses: Silicon Tetrachloride, Silicones, Silicates and Zeolites, their uses.

Unit XII: Organic Chemistry -Some Basic Principles and Technique 14 Periods

General introduction, methods of purification, qualitative and quantitative analysis, classification and IUPAC nomenclature of organic compounds. Electronic displacements in a covalent bond: inductive effect, electromeric 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 XIII: Hydrocarbons 12 Periods

Classification of 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 (Markownikov'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 monosubstituted benzene. Carcinogenicity and toxicity.

Unit XIV: Environmental Chemistry

06 Periods

Environmental pollution - air, water and soil pollution, chemical reactions in atmosphere, smog, major atmospheric pollutants, acid rain, ozone and its reactions, effects of depletion of ozone layer, greenhouse effect and global warming- pollution due to industrial wastes, green chemistry as an alternative tool for reducing pollution, strategies for control of environmental pollution.

PRACTICALS

| Evaluation Scheme for Examination | Marks |
|-----------------------------------|-----------|
| Volumetric Analysis | 08 |
| Salt Analysis | 08 |
| Content Based Experiment | 06 |
| Project Work | 04 |
| Class record and viva | 04 |
| Total | 30 |

PRACTICAL SYLLABUS

Total Periods 60

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

(a) 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 universal indicator.

(b) Study the pH change by common-ion in case of weak acids and weak bases.

D. Chemical Equilibrium

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 $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and chloride ions by changing the concentration of either of the ions.

E. Quantitative Estimation

- Using a chemical balance.
- Preparation of standard solution of Oxalic acid.
- Determination of strength of a given solution of Sodium Hydroxide by titrating it against standard solution of Oxalic acid.
- Preparation of standard solution of Sodium Carbonate.
- Determination of strength of a given solution of Hydrochloric acid by titrating it against standard Sodium Carbonate solution.

F. Qualitative Analysis

(a) Determination of one anion and one cation in a given salt

Cations- Pb^{2+} , Cu^{2+} , As^{3+} , 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-} , S^{2-} , SO_3^{2-} , SO_4^{2-} , NO_2^- , NO_3^- , Cl^- , Br^- , I^- , PO_4^{3-} , $\text{C}_2\text{O}_4^{2-}$, CH_3COO^-

(Note: Insoluble salts excluded)

(b) Detection of -Nitrogen, Sulphur, Chlorine in organic compounds.

PROJECT

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

A few suggested Projects

- Checking the bacterial contamination in drinking water by testing sulphide ion.
- Study of the methods of purification of water.
- 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).
- Investigation of the foaming capacity of different washing soaps and the effect of addition of Sodium Carbonate on it.
- Study the acidity of different samples of tea leaves.
- Determination of the rate of evaporation of different liquids.
- Study the effect of acids and bases on the tensile strength of fibers.
- 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.

Practical Examination for Visually Impaired Students Class XI

Note: Same Evaluation scheme and general guidelines for visually impaired students as given for Class XII may be followed.

A. List of apparatus for identification for assessment in practicals (All experiments)

Beaker, Tripod stand, Wire gauze, glass rod, funnel, filter paper, Bunsen burner, test tube, test tube stand, dropper, test tube holder, ignition tube, china dish, tongs, funnel, tripod stand, wire gauze, Bunsen burner, standard flask, pipette, burette, conical flask, funnel, clamp stand, dropper, wash bottle, filter paper

- Odour detection in qualitative analysis
- Procedure/Setup of the apparatus

B. List of Experiments

A. Characterization and Purification of Chemical Substances

1. Crystallization of an impure sample of any one of the following: copper sulphate, benzoic acid

B. Experiments based on pH

1. Determination of pH of some solutions obtained from fruit juices, solutions of known and varied concentrations of acids, bases and salts using pH paper
2. Comparing the pH of solutions of strong and weak acids of same concentration.

C. Chemical Equilibrium

1. Study the shift in equilibrium between ferric ions and thiocyanate ions by increasing/decreasing the concentration of either ions.
2. Study the shift in equilibrium between $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ and chloride ions by changing the concentration of either of the ions.

D. Quantitative estimation

1. Preparation of standard solution of oxalic acid.
2. Determination of molarity of a given solution of sodium hydroxide by titrating it against standard solution of oxalic acid.

E. Qualitative Analysis

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

2. Cations- NH_4^+

Anions - CO_3^{2-} , S^{2-} , SO_3^{2-} , Cl^- , CH_3COO^-

(Note: insoluble salts excluded)

3. Detection of Nitrogen in the given organic compound.
4. Detection of Halogen in the given organic compound.

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

Prescribed Books:

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

CHEMISTRY (Code No. 043)
QUESTION PAPER DESIGN
CLASS - XI (2016-17)

Time 3 Hours

Max. Marks: 70

| S. No. | Typology of Questions | Very Short Answer (VSA) (1 mark) | Short Answer-I (SA-I) (2 marks) | Short Answer -II (SA-II) (3 marks) | Value based question (4 marks) | Long Answer (LA) (5 marks) | Total Marks | % Weightage |
|--------------|---|----------------------------------|---------------------------------|------------------------------------|--------------------------------|----------------------------|---------------|-------------|
| 1. | Remembering- (Knowledge based Simple recall questions, to know specific facts, terms, concepts, principles, or theories, Identify, define, or recite, information) | 2 | 1 | 1 | - | - | 7 | 10% |
| 2 | Understanding- Comprehension -to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase information) | - | 2 | 4 | - | 1 | 21 | 30% |
| 3 | Application (Use abstract information in concrete situation, to apply knowledge to new situations, Use given content to interpret a situation, provide an example, or solve a problem) | - | 2 | 4 | - | 1 | 21 | 30% |
| 4 | High Order Thinking Skills (Analysis & Synthesis- Classify, compare, contrast, or differentiate between different pieces of information, Organize and/or integrate unique pieces of information from a variety of sources) | 2 | - | 1 | - | 1 | 10 | 14% |
| 5 | Evaluation- (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values) | 1 | - | 2 | 1 | - | 11 | 16% |
| TOTAL | | 5x1=5 | 5x2=10 | 12x3=36 | 1x4=4 | 3x5=15 | 70(26) | 100% |

QUESTION WISE BREAK UP

| Type of Question | Mark per Question | Total No. of Questions | Total Marks |
|------------------|-------------------|------------------------|-------------|
| VSA | 1 | 5 | 05 |
| SA-I | 2 | 5 | 10 |
| SA-II | 3 | 12 | 36 |
| VBQ | 4 | 1 | 04 |
| LA | 5 | 3 | 15 |
| Total | | 26 | 70 |

1. **Internal Choice:** *There is no overall choice in the paper. However, there is an internal choice in one question of 2 marks weightage, one question of 3 marks weightage and all the three questions of 5 marks weightage.*
2. *The above template is only a sample. Suitable internal variations may be made for generating similar templates keeping the overall weightage to different form of questions and typology of questions same.*

CLASS XII (2016-17)
(THEORY)

Total Periods (Theory 160 + Practical 60)

Time: 3 Hours

70 Marks

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

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, colligative properties - relative lowering of vapour pressure, Raoult's law, 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, 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, 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, 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; 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, mechanism of substitution reactions, optical rotation.

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: Organic compounds containing Nitrogen **10 Periods**

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

Cyanides and Isocyanides - will be mentioned at relevant places in text.

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 Periods

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

| Evaluation Scheme for Examination | Marks |
|-----------------------------------|-----------|
| Volumetric Analysis | 08 |
| Salt Analysis | 08 |
| Content Based Experiment | 06 |
| Project Work | 04 |
| Class record and viva | 04 |
| Total | 30 |

PRACTICALS SYLLABUS

60 Periods

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, (KIO_3) and Sodium Sulphite: (Na_2SO_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 $Zn/Zn^{2+} || Cu^{2+}/Cu$ with change in concentration of electrolytes ($CuSO_4$ or $ZnSO_4$) 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

- i) Preparation of double salt of Ferrous Ammonium Sulphate or Potash Alum.
- ii) Preparation of Potassium Ferric Oxalate.

G. Preparation of Organic Compounds

Preparation of any one of the following compounds

- i) Acetanilide
- ii) Di-benzal Acetone
- iii) p-Nitroacetanilide
- iv) 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 food stuffs.

J. Determination of concentration/ molarity of $KMnO_4$ 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 - Pb^{2+} , Cu^{2+} , As^{3+} , Al^{3+} , Fe^{3+} , Mn^{2+} , Zn^{2+} , Cu^{2+} , Co^{2+} , Ni^{2+} , Ca^{2+} , Sr^{2+} , Ba^{2+} , Mg^{2+} , NH_4^+

Anions - CO_3^{2-} , S^{2-} , SO_3^{2-} , SO_4^{2-} , NO_2^- , NO_3^- , Cl^- , Br^- , I^- , PO_4^{3-} , $\text{C}_2\text{O}_4^{2-}$, CH_3COO^-

(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 soyabean 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 powder, 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 XI and 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 |
| Total | 30 marks |

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 for assessment may be generated jointly by the external/internal examiners.
- 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 practicals(All experiments)

Beaker, glass rod, tripod stand, wire gauze, Bunsen burner, Whatman 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, Tripod stand, burner, wire gauze, 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_f values (Constituents having large difference in R_f values to 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 food stuffs.

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_4 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 - NH_4^+

Anions - CO_3^{2-} , S^{2-} , SO_3^{2-} , Cl^- , CH_3COO^-

(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
CLASS - XII (2016-17)

Time 3 Hours

Max. Marks: 70

| S. No. | Typology of Questions | Very Short Answer (VSA) (1 mark) | Short Answer-I (SA-I) (2 marks) | Short Answer -II (SA-II) (3 marks) | Value based question (4 marks) | Long Answer (LA) (5 marks) | Total Marks | % Weightage |
|--------|---|----------------------------------|---------------------------------|------------------------------------|--------------------------------|----------------------------|---------------|-------------|
| 1. | Remembering- (Knowledge based) Simple recall questions, to know specific facts, terms, concepts, principles, or theories, Identify, define, or recite, information) | 2 | 1 | 1 | - | - | 7 | 10% |
| 2 | Understanding- Comprehension -to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase information) | - | 2 | 4 | - | 1 | 21 | 30% |
| 3 | Application (Use abstract information in concrete situation, to apply knowledge to new situations, Use given content to interpret a situation, provide an example, or solve a problem) | - | 2 | 4 | - | 1 | 21 | 30% |
| 4 | High Order Thinking Skills (Analysis & Synthesis- Classify, compare, contrast, or differentiate between different pieces of information, Organize and/or integrate unique pieces of information from a variety of sources) | 2 | - | 1 | - | 1 | 10 | 14% |
| 5 | Evaluation- (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values) | 1 | - | 2 | 1 | - | 11 | 16% |
| | TOTAL | 5x1=5 | 5x2=10 | 12x3=36 | 1x4=4 | 3x5=15 | 70(26) | 100% |

QUESTION WISE BREAK UP

| Type of Question | Mark per Question | Total No. of Questions | Total Marks |
|------------------|-------------------|------------------------|-------------|
| VSA | 1 | 5 | 05 |
| SA-I | 2 | 5 | 10 |
| SA-II | 3 | 12 | 36 |
| VBQ | 4 | 1 | 04 |
| LA | 5 | 3 | 15 |
| Total | | 26 | 70 |

1. **Internal Choice:** *There is no overall choice in the paper. However, there is an internal choice in one question of 2 marks weightage, one question of 3 marks weightage and all the three questions of 5 marks weightage.*
2. *The above template is only a sample. Suitable internal variations may be made for generating similar templates keeping the overall weightage to different form of questions and typology of questions same.*