

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 curriculum of Chemistry at Senior Secondary Stage aims to:

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

COURSE STRUCTURE CLASS-XI (THEORY) (2020-21)

Time: 3Hours

Total Periods (Theory 119 +Practical 44)
TotalMarks70

Unit No.	Title	No. of Periods	Marks
Unit I	Some Basic Concepts of Chemistry	10	11
Unit II	Structure of Atom	12	
Unit III	Classification of Elements and Periodicity in Properties	6	04
Unit IV	Chemical Bonding and Molecular Structure	14	21
Unit V	States of Matter: Gases and Liquids	9	
Unit VI	Chemical Thermodynamics	14	
Unit VII	Equilibrium	12	
Unit VIII	Redox Reactions	4	16
Unit IX	Hydrogen	4	
Unit X	s -Block Elements	5	
Unit XI	Some p -Block Elements	9	
Unit XII	Organic Chemistry: Some basic Principles and Techniques	10	18
Unit XIII	Hydrocarbons	10	
	Total	119	70

Unit I: Some Basic Concepts of Chemistry **10 Periods**

General Introduction: Importance and scope of Chemistry.

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 **12 Periods**

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** **06 Periods**
 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** **9 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 and deviation from ideal behavior.
- Unit VI: Chemical Thermodynamics** **14 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, 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.
 Third law of thermodynamics (brief introduction).
- Unit VII: Equilibrium** **12 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, buffer solution, solubility product, common ion effect (with illustrative examples).
- Unit VIII: Redox Reactions** **04 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.
- Unit IX: Hydrogen** **04 Periods**
 Position of hydrogen in periodic table, occurrence, isotopes, hydrides-ionic covalent and interstitial; physical and chemical properties of water, heavy water, hydrogen as a fuel.

- Unit X: s-Block Elements (Alkali and Alkaline Earth Metals)** **5 Period**
 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.
- Unit XI: Some p-Block Elements** **9 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.
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.
- Unit XII: Organic Chemistry - Some Basic Principles and Techniques** **10 Periods**
 General introduction, 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** **10 Periods**
Classification of Hydrocarbons
Aliphatic Hydrocarbons:
 Alkanes - Nomenclature, isomerism, conformation (ethane only), physical properties, chemical reactions.
 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 monosubstituted benzene. Carcinogenicity and toxicity.

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:44

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 glassrod
2. Bending a glasstube
3. Drawing out a glassjet
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. Quantitative Estimation

- i. Using a mechanical balance/electronic balance.
- ii. Preparation of standard solution of Oxalic acid.
- iii. Determination of strength of a given solution of Sodium hydroxide by titrating it against standard solution of Oxalic acid.
- iv. Preparation of standard solution of Sodium carbonate.
- v. Determination of strength of a given solution of hydrochloric acid by titrating it against standard Sodium Carbonate solution.

D. 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 – $(\text{CO}_3)^{2-}$, S^{2-} , NO_2^- , SO_3^{2-} , SO_4^{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.

c) PROJECTS

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.

QUESTION PAPER DESIGN
CLASSES –XI and XII (2020-21)
CHEMISTRY (Code No. 043)

1. There shall be two different parts in the Board examination for the year 2020-21. The two-part Assessment will carry weightage of fifty percent for each section.

Part A will be the objective type exams OMR/ Computer based test for the complete rationalized syllabus for 2020-21. It will comprise of MCQ as well as Assertion/ Reasoning type questions. MCQ and Assertion/ Reasoning type questions will include the format of case based/ source based/ integrated questions.

Part B will be a subjective/descriptive type test for the complete rationalized syllabus for 2020-21, announced by the board and that will be held with the objective type test.

2. No chapter wise weightage. Care to be taken to cover all the chapters.

3. Suitable *internal variations may be made for generating various templates.*

4. **Choice(s):**

- There will be no overall choice in the question paper. However internal choices will be given in all these sections.
- 33% Choice will be given in both sections (Part A and Part B) separately

PART A: Objective type Paper

Type	Marks for each question	No. of Questions	Total Marks	Percentage
Objective	1	19	19	54.29
	2	5	10	28.57
CaseBased	3	2	6	17.14
Total		26	35	100

PART B: Descriptive paper

Type	Marks for each question	No. of Questions	Total Marks	percentage
Short Answer- I	2	4	8	22.86
Short Answer- II	3	4	12	34.28
Long Answer	5	3	15	42.86
Total		11	35	100

S.No	Domains	Total Marks	%
1	<p>Remembering and Understanding: 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.</p>	28	40
2	<p>Applying: Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.</p>	21	30
3	<p>Analysing, Evaluating and Creating: 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 alternativesolutions.</p>	21	30