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 tertiarylevel.
- 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 andtechnology.
- equip students to face various challenges related to health, nutrition, environment, population, weather, industries andagriculture.
- develop problem solving skills instudents.
- expose the students to different processes used in industries and their technologicalapplications.
- apprise students with interface of chemistry with other disciplines of science such as physics, biology, geology, engineeringetc.
- acquaint students with different aspects of chemistry used in dailylife.
- develop an interest in students to study chemistry as adiscipline.
- integrate life skills and values in the context ofchemistry.

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

Total Periods (Theory 119 +Practical 44)

Time:3Hours **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 ConceptsofChemistry **10Periods**

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: StructureofAtom **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 PeriodicityinProperties 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 andMolecular Structure 14Periods

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: Gasesand Liquids 9Periods

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: ChemicalThermodynamics 14Periods

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: RedoxReactions 04Periods

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.

UnitIX: Hydrogen 04Periods

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 AlkalineEarth Metals) 5Period

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: Somep-BlockElements 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.

UnitXII: Organic Chemistry -Some Basic PrinciplesandTechniques 10 Periods

General introduction, classification

andIUPACnomenclatureoforganiccompounds.Electronicdisplacementsinacovalentbond: inductive effect, electromericeffect, 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 10Periods

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 electrophilicaddition.

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 ChemicalSubstances

1. Determination of melting point of an organiccompound.
2. Determination of boiling point of an organiccompound.
3. Crystallization of impure sample of any one of the following: Alum, Copper Sulphate, BenzoicAcid.

C. QuantitativeEstimation

i. Using a mechanical balance/electronicbalance.
ii. Preparation of standard solution of Oxalicacid.
iii. Determination of strength of a given solution of Sodium hydroxide by titrating it against standard solution of Oxalicacid.
iv. Preparation of standard solution of Sodiumcarbonate.
v. Determination of strength of a given solution of hydrochloric acid by titrating it against standard Sodium Carbonatesolution.

D. QualitativeAnalysis

a) Determination of one anion and one cation in a givensalt

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-}, NO_2^-, SO_3^{2-}, SO^{2-}_4 NO_3^-, Cl^-, Br^-, I^-, PO_4^{3-}, $C_2O^{2-}_4$,CH_3COO^-

(Note: Insoluble salts excluded)

b) Detection of -Nitrogen, Sulphur, Chlorine in organiccompounds.

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 sulphideion
- Study of the methods of purification ofwater
- 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 (ifany).
- Investigation of the foaming capacity of different washing soaps and the effect of addition of Sodium carbonate onit
- Study the acidity of different samples of tealeaves.
- Determination of the rate of evaporation of differentliquids
- Study the effect of acids and bases on the tensile strength offibers.
- Study of acidity of fruit and vegetablejuices.

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 (Allexperiments)

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, standard flask, pipette, burette, conical flask, clamp stand, dropper, wash bottle

- Odour detection in qualitativeanalysis
- Procedure/Setup of theapparatus

B. List ofExperiments

A. Characterization and Purification of ChemicalSubstances

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

B. Experiments based onpH

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

C. Quantitativeestimation

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

D. QualitativeAnalysis

1. Determination of one anion and one cation in a givensalt
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 organiccompound.
4. Detection of Halogen in the given organiccompound.

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 byNCERT.
2. Chemistry Part – II, Class-XI, Published byNCERT.

Practical Examination for Visually Impaired Students of Classes XI and XII
Evaluation Scheme

Time Allowed:Twohours **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 hourduration.
- A separate list of ten experiments is includedhere.
- The written examination in practicals for these students will be conducted at the time of practical examination of all otherstudents.
- The written test will be of 30 minutesduration.

- 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 10questions.
- A writer may be allowed to such students as per CBSE examinationrules.
- All questions included in the question papers should be related to the listed practicals. Every question should require about two minutes to beanswered.
- 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 internalexaminer.
- The format of writing any experiment in the practical file should include aim, apparatus required, simple theory, procedure, related practical skills, precautionsetc.
- Questions may be generated jointly by the external/internal examiners and used forassessment.
- The viva questions may include questions based on basic theory/principle/concept, apparatus/materials/ chemicals required, procedure, precautions, sources of erroretc.

A. Items for Identification/Familiarity of the apparatus for assessment in practical (Allexperiments)

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, funnel, filter paper

Hands-on Assessment

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

B. List ofPracticals

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

SECTION- A

A Chromatography

(1) Separation of pigments from extracts of leaves and flowers by paper chromatography and determination of R_f values (distance values may beprovided).

B Tests for the functional groups present in organiccompounds:

(1) Alcoholic and Carboxylicgroups.

(2) Aldehydic andKetonic

C Characteristic tests of carbohydrates and proteins in the givenfoodstuffs.

D Preparation of Inorganic Compounds- PotashAlum

SECTION-B (Mandatory)

E Quantitativeanalysis

(1) (a) Preparation of the standard solution of Oxalic acid of a givenvolume

(b) Determination of molarity of $KMnO_4$ solution by titrating it against a standard solution of Oxalicacid.

(2) The above exercise [F 1 (a) and (b)] to be conducted using Ferrous ammonium sulphate (Mohr'ssalt)

F Qualitativeanalysis:

(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 byNCERT.
2. Chemistry Part -II, Class-XII, Published byNCERT.

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 asAssertion/ 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 thechapters.
3. Suitable *internal variations may be made for generating varioustemplates.*
4. **Choice(s):**

   - There will be no overall choice in the questionpaper.Howeverinternal choices will be given in all thesections.
   - 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	**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.	28	40
2	**Applying:** Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	21	30
3	**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.	21	30