NBSE Class 11 Chemistry Syllabus

CHEMISTRY

Objectives:

The broad objectives of teaching chemistry at Higher Secondary stage are to help the learners:

- To promote understanding of basic facts and concepts in chemistry while retaining the excitement of chemistry.
- To develop an interest in students to study chemistry as discipline.
- To strengthen the concepts developed at the secondary stage and to provide firm; foundation for further learning of chemistry at tertiary level more effectively.
- To make students capable of studying chemistry in academic and professional courses (such as medicine, engineering, technology) at tertiary level.
- To develop positive scientific attitude and to appreciate contribution of chemistry towards the improvement of quality of human life.
- To expose the students to various emerging new areas of chemistry, and to different processes used in industries and their technological applications.
- To equip students to face various changes related to health, nutrition, environment, population, weather, industries and agriculture.
- To develop problem solving skills and nature curiosity, aesthetic sense and creativity.
- To inculcate values of honesty, integrity, concern for life and preservation of the environment.
- To make the learner realize the interface of chemistry with other discipline of science such as Physics, Biology, Geology, Geography etc.
- To acquaint students with different aspects of chemistry used in daily life.

DESIGN OF QUESTION PAPER

CHEMISTRY

Weightage to different forms of questions:

Sl. no.	Forms of Questions	Marks for each question	No. of questions	Total marks
1.	MCQ	1	5	5
2.	VSA	1	5	5
3.	SA- I	2	6	12
4.	SA- II	3	11	33
5.	LA	5	3	15
	Total		**30**	**70**

Weightage level of questions:

Sl.no.	Level	Percentage	Marks
1.	Easy	15	11
2.	Average	70	49
3.	Difficult	15	10

The expected time to be taken under different forms of questions shall be as follows:

Sl.no.	Forms of questions	Expected time for each question	Total expected time
1.	MCQ	-	3 minutes
2.	VSA	1 minute	5 minutes
3.	SA- I	4 minutes	24 minutes
4.	SA- II	8 minutes	88 minutes

5.	LA	15 minutes	45 minutes
6.	Reading Q.paper & Revision	15 minutes	15 minutes
		Total time	**180 minutes**

Scheme of options:

1. There will be no overall option.
2. Internal choice (parallel question) shall be provided in :
   i. any 3(three) questions in 2 marks
   ii. any 4(four) questions in 3 marks
   iii. 3(three) questions in 5 marks
3. Weightage of about 10 marks shall be assigned to numerical problems.

CLASS - XI
CHEMISTRY (Theory)

Unit-wise weightage

Theory Paper **Time: 3 Hrs.** **Marks: 70**

Unit		Marks
I.	Some Basic Concepts of Chemistry	3
II.	Structure of Atom	6
III.	Classification of Elements and Periodicity in Properties	4
IV.	Chemical Bonding and Molecular Structure	6
V.	States of Matter: Gases and Liquids	4
VI.	Thermodynamics	6
VII.	Equilibrium	6
VIII.	Redox Reactions	3
IX.	Hydrogen	3
X.	s-Block Elements	5
XI.	Some p-Block Elements	6
XII.	Organic Chemistry: Some Basic Principles & Techniques	7
XIII.	Hydrocarbons	8
XIV.	Environmental Chemistry	3
	Total	**70**

Part – A: External

Unit I: Some Basic Concepts of Chemistry **3 marks/14 periods**

General Introduction: Importance and scope of chemistry.

Historical approach to particulate nature of matter, laws of chemical combination. *Dalton's atomic theory*: concepts 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 **6 marks/16 periods**

Discovery of electron, proton and neutron; atomic number, isotopes and isobars. Thompson'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's 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 **4 marks/8 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, electro negativity, valence. Nomenclature of elements with atomic number greater than 100.

Unit IV: Chemical Bonding and Molecular Structure **6 marks/16 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 **4 marks/12 periods**

Three states of matter. Intermolecular interactions, type of bonding, melting and boiling points. Role of gas laws in elucidating the concept of the molecule, Boyle's law, Charle's law, Gay Lussac's law, Avogadro's law. Ideal behaviour, empirical derivation of gas equation, Avogadro's number. Ideal gas equation. Kinetic energy and molecular speeds (elementary idea). derivation from ideal behaviour, liquefaction of gases, critical temperature.

Liquid State-Vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations).

Unit VI: Thermodynamics **6 marks/18 periods**

Concepts of system, 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.

Introduction of entropy as a state function, Second law of thermodynamics. Gibbs energy change for spontaneous and non-spontaneous process, criteria for equilibrium.

Third law of thermodynamics – Brief introduction.

Unit VII: Equilibrium **6 marks/20 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 polybasic acids, acid strength, concept of pH, Hydrolysis of salts (elementary idea). Buffer solutions, Henderson Equation, solubility product, common ion effect (with illustrative examples).

Unit VIII: Redox Reactions **3 marks/6 periods**

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

Unit IX: Hydrogen **3 marks/8 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, properties, use and structure; hydrogen as a fuel.

Unit X: s-Block Elements (Alkali and Alkaline earth metals) 5 marks/12 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 hydrogen carbonate, biological importance of sodium and potassium.

CaO, $CaCO_3$ and industrial use of lime and limestone, biological importance of Mg and Ca.

Unit XI: Some p-Block Elements. 6 marks/16 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 acids, boron hydrides. Aluminium: uses, reactions with acids and alkalies.

Group 14 elements: General introduction, electronic configuration, occurrence, variation of properties, oxidation states, trends in chemical reactivity, anomalous behaviour of first element, 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 Techniques.

7 marks/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 8 marks/16 periods

Classification of hydrocarbons

Aliphatic Hydrocarbons:

Alkanes–Nomenclature, isomerism, conformations (ethane only), Physical properties, chemical reactions including free radical, mechanism of halogenation, combustion and pyrolysis.

Alkenes–Nomenclature, structure of double bond (ethene), geometrical isomerism, physical properties, methods of preparation; chemical reactions: addition of hydrogen,

halogen, water, hydrogen halides (Markovnikov's addition and peroxide effect), ozonolysis, oxidation, mechanism of electrophilic addition.

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

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

Unit XIV: Environmental Chemistry **3 marks/4 periods**

Environmental pollutant-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, strategy for control of environmental pollution.

Part – B: Internal (Practical)

Micro-chemical methods are available for several of the practical experiments. Whenever 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 substance.

1. Determination of melting point of an organic compound.
2. Determination of boiling point of an organic compound.
3. Crystallization involving impure sample of any one of the following:

Alum, copper sulphate, Benzoic acid.

C. Experiments related to pH change

(a) Any one of the following experiments:

i. 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.

ii. Comparing the pH of solutions of strong and weak acid of same concentration.

iii. Study the pH change in the titration of a strong acid with a strong base using universal indicator.

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

D. Chemical Equilibrium

One of the following experiments:

(a) Study the shift in equilibrium between ferric ions and thiocynate ions by increasing/decreasing the concentration of either of the ions.

(b) Study the shift in equilibrium between $[Co(H_2O)_6]^{2+}$ and chloride ions by changing the concentration of either of the ions.

E. Quantitative Estimation

- 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+}, $A1^{3+}$, 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-}, $C_2O_4^{2-}$, 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 the 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 them.
- Study of the acidity of different samples of the tea leaves.
- Determination of the rate of evaporation of different liquids.
- Study of the effect of acids and bases on the tensile strength of fibres.
- Analysis of fruit and vegetables juices for their acidity.

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

Practical

Evaluation Scheme for Practical Examination	**Marks**
Volumetric Analysis .	**10 marks**
Salt Analysis.	**8marks**
Content Based Experiment.	**6 marks**
Class record and viva on experiment & project.	**6 marks**
Total	**30 marks**

1. ***Prescribed textbook:***
   Chemistry for class XI by Dr. S.K. Jain ***- S. Chand & Company Ltd, Ram Nagar, New Delhi – 110055***

2. ***Reference book:***
   Modern ABC of Chemistry by Dr. S.P Jauhar ***- Modern Publishers MBD House, Railway Road, Jalandhar City.***

3. ***Laboratory Manual Book:***
   CHEMISTRY Class XI ***- Academic Publishers Kohima, Nagaland***