### COURSE STRUCTURE

**CLASS-XI (THEORY) (2016-17)**

Total Periods (Theory 160 + Practical 60)

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

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

- 12 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**

- 14 Periods
Unit III: Classification of Elements and Periodicity in Properties
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
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
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 States- vapour pressure, viscosity and surface tension (qualitative idea only, no mathematical derivations)

Unit VI: Chemical Thermodynamics
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 $\Delta U$ and $\Delta H$, 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
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
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
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 alkalis, 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


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.

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

<table>
<thead>
<tr>
<th>Evaluation Scheme for Examination</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volumetric Analysis</td>
<td>08</td>
</tr>
<tr>
<td>Salt Analysis</td>
<td>08</td>
</tr>
<tr>
<td>Content Based Experiment</td>
<td>06</td>
</tr>
<tr>
<td>Project Work</td>
<td>04</td>
</tr>
<tr>
<td>Class record and viva</td>
<td>04</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

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:

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

b) Study the shift in equilibrium between $[Co(H_2O)_6]^{3+}$ and chloride ions by changing the concentration of either of the ions.

E. Quantitative Estimation

i) Using a chemical 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.

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$_4^{2-}$, NO$_3^-$, NO$_2^-$, Cl$^-$, Br$^-$, I$^-$, PO$_4^{3-}$, C$_2$O$_4^{2-}$, CH$_3$COO$^-$

(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 [Co(H₂O)₆]³⁺ 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: \(\text{NH}_4^+\)
         Anions: \(\text{CO}_3^{2-}, \text{S}^{2-}, \text{SO}_4^{2-}, \text{Cl}^-, \text{CH}_3\text{COO}^-\)
         (Note: insoluble salts excluded)
      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.
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Typology of Questions</th>
<th>Very Short Answer (VSA) (1 mark)</th>
<th>Short Answer-I (SA-I) (2 marks)</th>
<th>Short Answer-II (SA-II) (3 marks)</th>
<th>Value based question (4 marks)</th>
<th>Long Answer (LA) (5 marks)</th>
<th>Total Marks</th>
<th>% Weightage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Remembering- (Knowledge based Simple recall questions, to know specific facts, terms, concepts, principles, or theories, identify, define, or recite, information)</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>7</td>
<td>10%</td>
</tr>
<tr>
<td>2</td>
<td>Understanding- Comprehension -to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase information</td>
<td></td>
<td>2</td>
<td>4</td>
<td>-</td>
<td>1</td>
<td>21</td>
<td>30%</td>
</tr>
<tr>
<td>3</td>
<td>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)</td>
<td></td>
<td>2</td>
<td>4</td>
<td>-</td>
<td>1</td>
<td>21</td>
<td>30%</td>
</tr>
<tr>
<td>4</td>
<td>High Order Thinking Skills (Analysis &amp; Synthesis- Classify, compare, contrast, or differentiate between different pieces of information, Organize and/or integrate unique pieces of information from a variety of sources)</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>1</td>
<td>10</td>
<td>14%</td>
</tr>
<tr>
<td>5</td>
<td>Evaluation- (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)</td>
<td>1</td>
<td>-</td>
<td>2</td>
<td>1</td>
<td>-</td>
<td>11</td>
<td>16%</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>5x1=5</td>
<td>5x2=10</td>
<td>12x3=36</td>
<td>1x4=4</td>
<td>3x5=15</td>
<td>70(26)</td>
<td>100%</td>
</tr>
</tbody>
</table>
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.