

LESSON PLAN

Subject:

Chemistry

Class:

XI (+1)

MONTH-APRIL

Chapter:1

Some Basic Concepts of Chemistry

Duration:

2–3 periods (40–45 minutes each)

1. Objectives

By the end of the lesson, students will be able to:

- Explain the importance of chemistry in daily life.
 - Define matter, mass, volume, and density.
 - Understand SI units and unit conversions.
 - Explain laws of chemical combination.
 - Differentiate atoms, molecules, and moles.
 - Calculate molar mass and percentage composition.
 - Solve numerical problems based on the mole concept.
 - Develop scientific thinking and problem-solving skills.
-

2. Previous Knowledge (Entry Behaviour)

The teacher will ask students:

- What is matter?
 - Name the three states of matter.
 - What is the symbol of hydrogen and oxygen?
 - What do you understand by an atom and a molecule?
 - What measuring units have you studied in Class X?
-

3. Innovative Methods

- Brainstorming
 - Activity-based learning
 - Question-answer method
 - Think-Pair-Share
 - ICT-enabled teaching (PowerPoint/Smart Board)
 - Demonstration using laboratory apparatus
 - Group discussion
 - Real-life examples
-

4. Procedure

Introduction (5–10 minutes)

- Greet the students.
- Show common objects such as water, salt, sugar, milk, and air.
- Ask: "What are these made of?"
- Introduce Chemistry as the study of matter and its changes.
- Write the topic on the board.

Presentation (25–30 minutes)

Discuss:

1. Importance of Chemistry
2. Nature of Matter
3. Properties of Matter
4. SI Units
5. Significant Figures
6. Scientific Notation
7. Laws of Chemical Combination
8. Atomic Mass
9. Molecular Mass
10. Mole Concept
11. Molar Mass
12. Percentage Composition

13. Empirical and Molecular Formula

14. Numerical Problems

Solve examples step-by-step on the board.

Recapitulation (5 minutes)

Ask oral questions:

- What is one mole?
 - Define molar mass.
 - State the law of conservation of mass.
 - What is Avogadro's number?
-

5. Participation of Students

Students will:

- Answer questions.
 - Participate in discussions.
 - Perform unit conversions.
 - Solve numerical problems individually.
 - Work in groups.
 - Present their answers before the class.
 - Ask doubts and clarify concepts.
-

6. Integration with Other Domains

Mathematics

- Ratios
- Percentages
- Scientific notation
- Unit conversion
- Numerical calculations

Physics

- SI units
- Measurement
- Density

Biology

- Chemical composition of living organisms

Environmental Science

- Chemicals used in agriculture and pollution control

Information Technology

- Use of simulations, smart board, and digital presentations
-

7. Learning Outcomes

Students will be able to:

- Describe the basic concepts of chemistry.
 - Use SI units correctly.
 - Apply the mole concept in calculations.
 - Calculate molecular mass and molar mass.
 - Solve numerical problems accurately.
 - Develop logical and analytical thinking.
 - Relate chemistry concepts to daily life.
-

8. Resources / Teaching Aids

- NCERT/PSEB Chemistry Textbook
 - Chalk and Blackboard/Whiteboard
 - Smart Board/Projector
 - PowerPoint Presentation
 - Periodic Table
 - Laboratory balance
 - Measuring cylinder
 - Beakers
 - Charts and Flashcards
 - Worksheets
-

9. Co-Scholastic Activities

- Chemistry Quiz

- Poster-making on "Chemistry in Everyday Life"
 - Group discussion
 - Model/chart preparation
 - Science club activities
 - Laboratory observation
 - Classroom presentation
-

10. Remedial Teaching

For slow learners:

- Revise basic concepts from Class X.
 - Provide simple notes and flowcharts.
 - Give additional practice on unit conversions and numericals.
 - Use peer tutoring.
 - Conduct short oral quizzes.
 - Give worksheet-based practice.
 - Provide individual guidance and feedback.
-

Assessment

Oral Questions

- What is chemistry?
- Define one mole.
- What is molar mass?
- State Avogadro's number.

Written Questions

1. State the law of conservation of mass.
2. Differentiate empirical and molecular formula.
3. Calculate the molar mass of H_2SO_4 .
4. Solve one numerical based on the mole concept.

Chapter:2

Structure of Atom

MONTH-MAY

Duration:

5–6 Periods (40–45 minutes each)

1. General Objectives

By the end of the chapter, students will be able to:

- Understand the historical development of atomic models.
 - Explain the structure of an atom.
 - Describe the discovery of subatomic particles.
 - Explain electromagnetic radiation and its properties.
 - Understand Planck's quantum theory and photoelectric effect.
 - Explain Bohr's model of hydrogen atom.
 - Describe quantum mechanical model of atom.
 - Understand quantum numbers and electronic configuration.
 - Apply Aufbau Principle, Pauli Exclusion Principle and Hund's Rule.
 - Solve numerical problems based on Bohr's theory and de Broglie equation.
 - Develop analytical thinking and scientific attitude.
-

2. Previous Knowledge (Entry Behaviour)

The teacher will ask students:

- What is an atom?
 - Who discovered the electron?
 - What are protons and neutrons?
 - What is the nucleus?
 - What do you know about electronic configuration from Class X?
 - Name the subatomic particles.
-

3. Innovative Methods

- Brainstorming
- Question-Answer Method
- Activity-based Learning
- Smart Board/PowerPoint Presentation

- Animation of Atomic Models
 - Think-Pair-Share
 - Group Discussion
 - Demonstration using charts and models
 - Problem-solving Method
-

4. Procedure

Introduction (5–10 minutes)

- Greet the students.
 - Show images/models of atoms.
 - Ask students:
 - Can we see an atom?
 - What is present inside an atom?
 - Introduce the chapter "**Structure of Atom.**"
-

Presentation (30 minutes)

Explain the following topics:

1. Discovery of Subatomic Particles

- Electron (J.J. Thomson)
- Proton (Goldstein)
- Neutron (James Chadwick)

2. Atomic Models

- Thomson's Model
- Rutherford's Model
- Bohr's Model

3. Electromagnetic Radiation

- Wave Nature
- Frequency
- Wavelength
- Velocity of Light

4. Planck's Quantum Theory

5. Photoelectric Effect

6. Dual Nature of Matter

- de Broglie Equation

7. Heisenberg's Uncertainty Principle

8. Quantum Mechanical Model

9. Atomic Orbitals

- s, p, d, f Orbitals

10. Quantum Numbers

- Principal (n)
- Azimuthal (l)
- Magnetic (m)
- Spin (s)

11. Electronic Configuration

- Aufbau Principle
- Pauli Exclusion Principle
- Hund's Rule

12. Numerical Problems

- Energy of electron
- Wavelength
- Frequency
- de Broglie equation
- Bohr's equation

Recapitulation (5 minutes)

Ask oral questions:

- Who discovered the electron?
- State Heisenberg's uncertainty principle.
- Define orbital.
- What is the maximum number of electrons in p-orbital?
- State Pauli Exclusion Principle.
- Write the electronic configuration of Sodium.

5. Participation of Students

Students will:

- Answer oral questions.
 - Observe atomic models and animations.
 - Participate in discussions.
 - Draw atomic models.
 - Solve numerical problems.
 - Write electronic configurations.
 - Work in groups.
 - Present their findings.
-

6. Integration with Other Domains

Physics

- Electromagnetic radiation
- Wave theory
- Photoelectric effect
- Quantum mechanics

Mathematics

- Logarithms
- Scientific notation
- Numerical calculations
- Algebra

Computer Science

- Computer simulations of atomic orbitals
- Digital animations

Environmental Science

- Applications of radioisotopes
 - Nuclear energy
-

7. Learning Outcomes

Students will be able to:

- Explain the evolution of atomic structure.
 - Describe different atomic models.
 - Explain quantum theory.
 - Differentiate orbit and orbital.
 - Identify different quantum numbers.
 - Write electronic configurations correctly.
 - Solve numerical problems related to Bohr's theory.
 - Apply Aufbau Principle, Hund's Rule and Pauli Principle.
 - Develop logical reasoning and scientific temperament.
-

8. Teaching Learning Material (TLM)

- NCERT Chemistry Textbook
 - Periodic Table
 - Atomic Models
 - Charts
 - Smart Board
 - PowerPoint Presentation
 - Videos/Animations
 - Flash Cards
 - Whiteboard and Markers
 - Worksheets
-

9. Co-Scholastic Activities

- Quiz on Atomic Models
- Chart Making: Evolution of Atomic Models
- Model Making of Atom
- Group Presentation
- Role Play (Scientists: Dalton, Thomson, Rutherford, Bohr)
- Classroom Debate: Bohr Model vs Quantum Model
- Science Club Activities

10. Remedial Teaching

For slow learners:

- Explain concepts using simple diagrams.
 - Revise Class X concepts of atom.
 - Use flowcharts and concept maps.
 - Provide solved numerical examples.
 - Conduct peer learning activities.
 - Give additional worksheets.
 - Individual doubt-clearing sessions.
 - Short oral quizzes for reinforcement.
-

11. Assessment

Oral Questions

1. Who discovered the neutron?
2. What is an orbital?
3. State de Broglie equation.
4. Define quantum number.
5. What is the maximum number of electrons in the M shell?

Written Questions

1. Explain Rutherford's atomic model and its limitations.
 2. State Heisenberg's Uncertainty Principle.
 3. Explain the four quantum numbers.
 4. Write the electronic configuration of:
 - Na (11)
 - Cl (17)
 - Ca (20)
 5. Solve one numerical based on Bohr's equation.
 6. Solve one numerical based on de Broglie wavelength.
-

Homework

- Learn the definitions of all four quantum numbers.
- Draw and label Thomson's, Rutherford's and Bohr's atomic models.
- Write the electronic configuration of the first 20 elements.

Chapter:3

Periodic Classification of Elements

MONTH-MAY

- **Duration:**
- 3–4 Periods (40–45 minutes each)
- _____
- **1. Objectives**
- By the end of the lesson, students will be able to:
- Explain the need for the classification of elements.
- Describe Dobereiner's Triads, Newlands' Law of Octaves, Mendeleev's Periodic Law and Modern Periodic Law.
- Explain the basis of the modern periodic table.
- Identify periods, groups, blocks and electronic configuration.
- Explain periodic trends in atomic radius, ionization enthalpy, electron affinity, electronegativity and metallic character.
- Compare the properties of different groups and periods.
- Apply periodic trends to solve conceptual and numerical problems.
- _____
- **2. Previous Knowledge (Entry Behaviour)**
- The teacher will ask students:
- What is an element?
- Name some metals and non-metals.
- What is an atomic number?
- How are electrons arranged in an atom?
- Have you studied the periodic table in Class X?
- _____
- **3. Innovative Methods**

- Interactive lecture
- Brainstorming
- Question–Answer method
- Activity-based learning
- Think–Pair–Share
- ICT-enabled teaching (Smart Board/PPT)
- Group discussion
- Periodic table puzzle/activity

- **4. Procedure**

- **Introduction (5–10 minutes)**

- Greet the students.
- Display a periodic table and ask students to identify familiar elements.
- Ask questions like:
 - Why are elements arranged in a table?
 - What similarities do sodium and potassium have?
- Introduce the topic "**Periodic Classification of Elements.**"

- **Presentation (25–30 minutes)**

- Discuss the following concepts:
 - Need for Classification of Elements
 - Dobereiner's Triads
 - Newlands' Law of Octaves
 - Mendeleev's Periodic Table
 - Modern Periodic Law
 - Long Form of the Periodic Table
 - Groups and Periods
 - s-, p-, d- and f-block Elements
 - Electronic Configuration and Position of Elements
 - Periodic Trends:
 - Atomic Radius

- Ionic Radius
- Ionization Enthalpy
- Electron Gain Enthalpy
- Electronegativity
- Metallic and Non-metallic Character
- Important Applications of the Periodic Table
- Use the periodic table chart to explain trends with suitable examples.

- **Recapitulation (5 minutes)**

- Ask oral questions such as:
- State the Modern Periodic Law.
- How many groups are present in the periodic table?
- Which block contains transition elements?
- Why does atomic radius decrease across a period?
- Which element has the highest electronegativity?

- **5. Participation of Students**

- Students will:
- Observe the periodic table carefully.
- Answer oral questions.
- Participate in group discussions.
- Identify the position of elements.
- Compare periodic properties.
- Solve conceptual and numerical questions.
- Present group activities.

- **6. Integration with Other Domains**

- **Physics**

- Atomic structure
- Electronic configuration

- **Mathematics**

- Graphs showing periodic trends
- Data interpretation
- **Biology**
- Importance of elements in living organisms
- **Environmental Science**
- Role of elements in pollution control and environmental protection
- **Information Technology**
- Digital periodic table
- Smart Board and online simulations

- **7. Learning Outcomes**

- Students will be able to:
- Explain the historical development of the periodic table.
- Classify elements into groups and periods.
- Locate elements using electronic configuration.
- Interpret periodic trends correctly.
- Predict chemical properties based on position in the periodic table.
- Solve application-based questions confidently.

- **8. Resources / Teaching Aids**

- NCERT Chemistry Textbook
- Periodic Table Chart
- Chalk and Blackboard/Whiteboard
- Smart Board/Projector
- PowerPoint Presentation
- Flashcards of Elements
- Worksheets
- Digital Periodic Table

- **9. Co-Scholastic Activities**

- Periodic Table Quiz

- Group Activity: Locate Elements
- Poster Making on "Evolution of the Periodic Table"
- Crossword Puzzle on Elements
- Classroom Presentation
- Science Club Activity

-

- **10. Remedial Teaching**

- For slow learners:
- Revise atomic structure and electronic configuration.
- Use colour-coded periodic tables.
- Explain trends using simple diagrams.
- Conduct one-to-one doubt sessions.
- Provide practice worksheets.
- Encourage peer learning.
- Give additional MCQs and short-answer questions for practice.

-

- **Assessment**

- **Oral Questions**

- State the Modern Periodic Law.
- How many periods and groups are present in the periodic table?
- Which block contains noble gases?
- Define ionization enthalpy.

- **Written Questions**

- Differentiate between Mendeleev's and the Modern Periodic Table.
- Explain the variation in atomic radius across a period.
- Why does electronegativity increase across a period?
- Write the electronic configuration and identify the position of sodium (Na) in the periodic table.
- Compare the properties of alkali metals and halogens.

-

Chemical Bonding and Molecular Structure

MONTH-JULY

Duration:

8–10 Periods (40–45 minutes each)

Learning Objectives

After completing this chapter, students will be able to:

- Explain the need for chemical bonding.
 - Describe the octet rule and its limitations.
 - Differentiate ionic, covalent and coordinate bonds.
 - Draw Lewis electron dot structures.
 - Explain VSEPR theory and predict molecular shapes.
 - Understand Valence Bond Theory (VBT).
 - Explain hybridization with orbital diagrams.
 - Describe molecular orbital theory (MOT).
 - Compare sigma (σ) and pi (π) bonds.
 - Calculate bond order and predict magnetic behaviour.
-

Previous Knowledge (Entry Behaviour)

Teacher asks:

- What is the electronic configuration of Na, Cl and O?
 - Why do noble gases remain stable?
 - What is a valence electron?
 - What is meant by electronic configuration?
-

Teaching Aids

- NCERT Textbook
- Smart Board/PPT
- Periodic Table
- Ball and Stick Models
- Orbital Charts

- Lewis Dot Structure Charts
 - Worksheets
-

Innovative Teaching Methods

- Brainstorming
 - ICT-based teaching
 - Model demonstration
 - Think-Pair-Share
 - Activity-based learning
 - Concept mapping
 - Group discussion
-

Content Development

Period 1

Introduction to Chemical Bonding

- Need for chemical bonding
- Kossel-Lewis approach
- Octet rule
- Exceptions to octet rule

Activity:

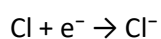
Students identify stable electronic configurations.

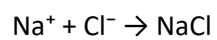
Period 2

Ionic Bond

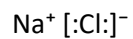
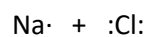
- Formation
- Properties
- Lattice energy
- Factors affecting ionic bond

Example





Lewis Dot Structure



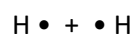
Period 3

Covalent Bond

- Single bond
- Double bond
- Triple bond
- Polar and non-polar covalent bonds

Lewis Structures

H_2



O_2



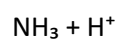
N_2



Period 4

Coordinate Bond

Examples



Period 5

VSEPR Theory

Shapes

Molecule Shape

BeCl₂ Linear

BF₃ Trigonal Planar

CH₄ Tetrahedral

NH₃ Trigonal Pyramidal

H₂O Bent

Period 6

Hybridization

sp Hybridization

2s 2p

↑↓ ↑ ↑

↓

sp sp

↑ ↑

Linear

180°

Example:

BeCl₂

sp² Hybridization

2s 2p

↑↓ ↑ ↑

↓

sp^2 sp^2 sp^2

↑ ↑ ↑

Trigonal Planar

120°

Example:

BF_3

sp^3 Hybridization

2s 2p

↑↓ ↑ ↑ ↑

↓

sp^3 sp^3 sp^3 sp^3

↑ ↑ ↑ ↑

Tetrahedral

109.5°

Example:

CH_4

sp^3d Hybridization

$s + 3p + d$

↓

Five sp^3d orbitals

Trigonal Bipyramidal

Example:

PCl_5

sp^3d^2 Hybridization

$s + 3p + 2d$

↓

Six equivalent orbitals

Octahedral

Example:

SF_6

Orbital Overlap Diagram

Sigma Bond (σ)

○ ○

----- σ -----

End-to-end overlap

Pi Bond (π)

() ()

==== π ====

Sidewise overlap

Period 7

Molecular Orbital Theory

Combination of atomic orbitals

A.O. M.O. A.O.

1s $\sigma 1s$ 1s

$\sigma^* 1s$

Bond Order

Bond Order = $\frac{1}{2}(N_b - N_a)$

Magnetic Behaviour

- $O_2 \rightarrow$ Paramagnetic
 - $N_2 \rightarrow$ Diamagnetic
-

Period 8

Hydrogen Bonding

- Intermolecular
- Intramolecular

Examples

- H_2O
- HF
- NH_3

Applications

- Ice is lighter than water.
 - High boiling point of water.
-

Student Participation

Students will

- Draw Lewis structures.

- Construct molecular models.
 - Predict molecular shapes.
 - Draw hybridization diagrams.
 - Solve bond order numericals.
 - Participate in quizzes.
-

Integration with Other Subjects

Physics

- Electron clouds
- Orbitals

Mathematics

- Bond angle calculations

Biology

- Hydrogen bonding in DNA

Environmental Science

- Ozone formation
 - Greenhouse gases
-

Learning Outcomes

Students will be able to

- Explain chemical bonding.
 - Predict molecular geometry.
 - Draw Lewis structures.
 - Explain hybridization.
 - Differentiate σ and π bonds.
 - Calculate bond order.
 - Explain magnetic properties using MOT.
-

Assessment

Oral Questions

1. Why do atoms form chemical bonds?

2. State the octet rule.
 3. What is hybridization?
 4. Differentiate ionic and covalent bonds.
 5. Define bond order.
-

Written Questions

1. Draw Lewis structures of CO_2 and NH_3 .
 2. Explain sp^3 hybridization using CH_4 .
 3. Predict the shape of NH_3 using VSEPR theory.
 4. Differentiate σ and π bonds.
 5. Calculate the bond order of O_2 .
-

Remedial Teaching

- Revision of electronic configuration.
- Practice Lewis dot structures.
- Use molecular models for visualization.
- Additional worksheets on hybridization and VSEPR.
- One-to-one guidance for numerical problems.
-
-

• CHAPTER 5

• Thermodynamics

- ---

MONTH-AUGUST
- **1. General Objectives**
- By the end of the lesson, students will be able to:
- Understand the concept of thermodynamics.
- Differentiate between system and surroundings.
- Explain different types of thermodynamic systems.
- Understand state functions and path functions.

- Apply the First Law of Thermodynamics.
- Explain internal energy, heat, and work.
- Understand enthalpy and enthalpy changes.
- Apply Hess's Law and calculate enthalpy changes.
- Develop numerical problem-solving skills.

• **2. Specific Learning Outcomes**

- Students will be able to:
- Define thermodynamics and its applications.
- Identify open, closed, and isolated systems.
- Distinguish between intensive and extensive properties.
- Explain internal energy (ΔU), heat (q), work (w), and enthalpy (H).
- State and apply the First Law of Thermodynamics.
- Explain endothermic and exothermic reactions.
- Calculate enthalpy changes using Hess's Law.
- Solve numerical problems based on ΔU , ΔH , q , and w .

• **3. Previous Knowledge (Entry Behaviour)**

- Teacher asks:
- What is energy?
- Can energy be created or destroyed?
- What happens when fuel burns?
- Give examples of heat-producing reactions.
- What do you understand by temperature?

• **4. Teaching Methods**

- Lecture-cum-discussion
- Demonstration
- Brainstorming
- Question-answer method
- Activity-based learning

- ICT (PowerPoint/Smart Board)
- Problem-solving method

-

- **5. Teaching Aids**

- NCERT Textbook
- Blackboard and Chalk
- Smart Board/Projector
- Charts
- Calorimeter
- Thermometer
- Spirit Lamp
- Beaker
- Periodic Table
- Worksheets

-

- **6. Introduction**

- Teacher shows a burning candle and a melting ice cube.
- Ask students:
- Why does a candle produce heat?
- Why does ice absorb heat before melting?
- Lead students to the concept of **energy transfer** and introduce the chapter **Thermodynamics**.

-

- **7. Presentation**

- **(A) Thermodynamic System**

- Definition:
A part of the universe selected for study.

- **Diagram**

- Surroundings

-

- 

- 

- | SYSTEM |
- | |
- |

-
- Surroundings

- **(B) Types of System**

- **(i) Open System**

- Exchange of both matter and energy.
- $\text{Matter} \leftrightarrow [\text{SYSTEM}] \leftrightarrow \text{Energy}$
- Example: Boiling water in an open vessel.

- **(ii) Closed System**

- Only energy is exchanged.
- Matter ✕
-
- $\text{Energy} \leftrightarrow [\text{SYSTEM}]$
- Example: Gas in a closed piston.

- **(iii) Isolated System**

- Neither matter nor energy is exchanged.
- Matter ✕
-
- Energy ✕
-
- $[\text{ISOLATED SYSTEM}]$
- Example: Thermos flask (ideal).

- **(C) State Functions**

- Internal Energy (U)
- Pressure (P)

- Volume (V)
- Temperature (T)
- Enthalpy (H)

- **(D) Path Functions**

- Heat (q)
- Work (w)

- **(E) Internal Energy**

- Total energy possessed by a system.
- $\Delta U = U_2 - U_1$

- **(F) First Law of Thermodynamics**

- Energy can neither be created nor destroyed.

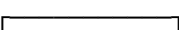
- **Mathematical Expression**

- $\Delta U = q + w$
- Where
- ΔU = Change in internal energy
- q = Heat supplied
- w = Work done on the system

- **(G) Work Done**

- Expansion Work
- Gas expands

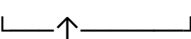
-

- 

- 

- 

- 

- 

- Piston moves up

- Formula
- $w = -P\Delta V$

-

- **(H) Enthalpy**

- $H = U + PV$
- At constant pressure,
- $\Delta H = qp$

-

- **(I) Exothermic Reaction**

- Heat is released.
- Reactants
- $\downarrow$
- Products + Heat
-
- $\Delta H < 0$
- Example:
- $\text{CH}_4 + 2\text{O}_2 \rightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{Heat}$

-

- **(J) Endothermic Reaction**

- Heat is absorbed.
- Heat + Reactants
- $\downarrow$
- Products
-
- $\Delta H > 0$
- Example:
- $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$

-

- **(K) Hess's Law**

- **Statement:**

- The total enthalpy change is independent of the path and depends only on the initial and final states.

- **Diagram**

- A -----> C

- \ ↑

- \ /

- \ /

- ----> B

-

- $\Delta H(A \rightarrow C)$

- =

- $\Delta H(A \rightarrow B) + \Delta H(B \rightarrow C)$

-

- **(L) Enthalpy of Reaction**

- Enthalpy of formation
- Enthalpy of combustion
- Enthalpy of neutralization
- Enthalpy of solution
- Enthalpy of atomization

-

- **(M) Numerical Practice**

- Calculate ΔU if $q = +50$ kJ and $w = -20$ kJ.
- Calculate work done when gas expands against 2 atm pressure with $\Delta V = 5$ L.
- Apply Hess's Law to calculate enthalpy change.

-

- **8. Student Participation**

- Students will:
- Draw diagrams.
- Answer oral questions.
- Differentiate between systems.
- Solve numerical problems.

- Participate in group discussion.
- Observe demonstrations.
- Explain exothermic and endothermic reactions.

- **9. Correlation with Other Subjects**

- **Physics**

- Heat and energy
- Work and pressure

- **Mathematics**

- Algebra
- Unit conversion
- Numerical calculations

- **Biology**

- Energy changes during metabolism

- **Environmental Science**

- Energy conservation
- Fuel efficiency

- **10. Recapitulation**

- Ask students:
- Define thermodynamics.
- What is an isolated system?
- State the First Law of Thermodynamics.
- Define enthalpy.
- Differentiate between exothermic and endothermic reactions.
- State Hess's Law.

- **11. Evaluation**

- **Oral Questions**

- What is a thermodynamic system?
- Define internal energy.

- Write the First Law of Thermodynamics.
- What is enthalpy?
- **Written Questions**
- Differentiate between open, closed, and isolated systems.
- Explain the First Law of Thermodynamics with equation.
- State Hess's Law.
- Explain exothermic and endothermic reactions with examples.
- Solve numericals based on $\Delta U = q + w$ and $w = -P\Delta V$.

- **12. Remedial Teaching**

- For slow learners:
- Revise the concepts of heat, work, and energy using daily-life examples.
- Provide flowcharts and concept maps.
- Give additional practice on sign conventions and numerical problems.
- Use peer learning and individual guidance.
- Conduct short quizzes and worksheet-based practice.

- **13. Co-Scholastic Activities**

- Group discussion on "**Energy Conservation in Daily Life.**"
- Chart preparation showing **types of thermodynamic systems.**
- Laboratory demonstration using a calorimeter.
- Quiz on thermodynamic terms and laws.
- Presentation on **applications of thermodynamics in industry and everyday life.**

- **Chapter: 6**

- **Chemical and Ionic Equilibrium**

- **MONTH-OCTOBER**

- **Duration: 4–5 periods (40–45 minutes each)**

- **1. Objectives**

- By the end of the lesson, students will be able to:

- Define **chemical equilibrium** and explain its dynamic nature.
- Differentiate between **reversible and irreversible reactions**.
- Explain **law of mass action** and equilibrium constant.
- Write expressions for **K_c and K_p**.
- Explain the effect of concentration, pressure and temperature using **Le Chatelier's principle**.
- Understand **ionic equilibrium** in aqueous solutions.
- Differentiate between **strong and weak electrolytes**.
- Explain **ionisation of weak acids and bases**.
- Understand **pH, pOH and ionic product of water**.
- Explain **common ion effect** and **buffer solutions**.
- Understand **solubility product (K_{sp})** and its applications.
- Apply concepts to numerical problems.

• **2. Previous Knowledge / Entry Behaviour**

- The teacher will ask:
- What is a chemical reaction?
- What is meant by a reversible reaction?
- What happens when a reaction reaches completion?
- What are acids and bases?
- What is an electrolyte?
- What is meant by concentration of a solution?
- Can a reaction proceed in both forward and backward directions?
- **Expected response:** Students should have basic knowledge of chemical reactions, acids, bases, solutions and concentration from previous classes.

• **3. Innovative Methods**

• **Demonstration method**

- Brainstorming
- Question–answer method
- Think–Pair–Share
- Group discussion

- Concept mapping
- Numerical problem-solving
- ICT/Smart Board animation
- Real-life examples
- Activity-based learning
- **Suggested activity:**
- Use a simple analogy of **students moving between two classrooms** to explain that at equilibrium, movement continues in both directions, but the rates become equal.

• **4. Procedure**

• **A. Introduction – 5 minutes**

- Teacher introduces the topic through a reversible reaction:
- $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$
- Ask students:
- **"Does the reaction completely stop when equilibrium is reached?"**
- Use their responses to introduce the concept of **dynamic equilibrium**.

• **B. Chemical Equilibrium – 15 minutes**

- Explain:
- Reversible reactions
- Dynamic nature of equilibrium
- Characteristics of chemical equilibrium
- Homogeneous and heterogeneous equilibrium
- Equilibrium constant
- Law of mass action
- Example:
- $a\text{A} + b\text{B} \rightleftharpoons c\text{C} + d\text{D} \quad K_c = \frac{[\text{A}]^a [\text{B}]^b}{[\text{C}]^c [\text{D}]^d}$

• **C. Le Chatelier's Principle – 15 minutes**

- Discuss the effect of:
- Change in concentration

- Change in pressure
- Change in temperature
- Addition of catalyst
- Use the Haber process as a real-life/industrial example.
- $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$
- Students predict the direction of equilibrium when pressure or concentration is changed.

• **D. Ionic Equilibrium – 20 minutes**

- Introduce ionic equilibrium in aqueous solutions.
- Discuss:
- Electrolytes
- Strong and weak electrolytes
- Ionisation of acids and bases
- Degree of ionisation
- Acid dissociation constant K_a
- Base dissociation constant K_b
- Ionic product of water K_w
- pH and pOH
- $\text{pH} = -\log[\text{H}^+]$ $\text{pOH} = -\log[\text{OH}^-]$ $\text{pH} + \text{pOH} = 14$

• **E. Applications of Ionic Equilibrium – 15 minutes**

- Explain:
- Common ion effect
- Buffer solutions
- Solubility equilibrium
- Solubility product K_{sp}
- Precipitation of ionic compounds
- Students solve simple numerical problems based on pH and equilibrium constants.

• **5. Participation of Students**

- Students will:

- Participate in brainstorming activities.
- Answer questions during the discussion.
- Predict the direction of equilibrium changes.
- Work in pairs/groups.
- Solve numerical problems.
- Prepare equilibrium concept maps.
- Perform simple classroom activities.
- Present their solutions to the class.
- Ask and answer peer questions.

-

• **6. Integration with Other Domains**

• **Mathematics**

- Logarithms
- Ratios and proportions
- Algebraic calculations
- Graphical representation

• **Physics**

- Pressure and temperature
- Effect of external conditions on systems

• **Biology**

- Acid–base balance in biological systems
- Buffer systems in living organisms

• **Environmental Science**

- Acid rain
- Water pollution
- Chemical equilibrium in natural water systems

• **Industrial Chemistry**

- Haber process
- Manufacture of ammonia
- Optimisation of industrial reactions

• **Information Technology**

- Digital simulations
- Interactive equilibrium graphs
- PowerPoint/Smart Board presentations

-

• **7. Learning Outcomes**

- After completion of the chapter, students will be able to:
- Explain the concept of dynamic equilibrium.
- Write equilibrium constant expressions.
- Apply Le Chatelier's principle.
- Explain the difference between chemical and ionic equilibrium.
- Calculate K_c , K_p , pH and pOH.
- Explain K_a , K_b , K_w and K_{sp} .
- Explain common ion effect and buffer action.
- Solve numerical problems based on equilibrium.
- Relate equilibrium concepts to industrial and everyday applications.

-

• **8. Resources / Teaching Aids**

- Chemistry textbook
- Blackboard/Whiteboard
- Smart Board/Projector
- Periodic table
- pH scale chart
- Equilibrium concept charts
- Molecular models
- Worksheets
- Numerical problem sheets
- Digital simulations/videos
- Laboratory apparatus and suitable indicators

-

• **9. Co-Scholastic Activities**

- **Chemistry Quiz:** Chemical vs Ionic Equilibrium

- **Group Activity:** Predict the shift in equilibrium
- **Poster:** "Equilibrium in Everyday Life"
- **Concept Map:** Factors affecting equilibrium
- **Presentation:** Industrial applications of equilibrium
- **pH Activity:** Classify common substances according to acidic/basic nature
- **Science Club Activity:** Demonstration related to equilibrium

-

- **10. Remedial Teaching**

- For students who face difficulty:
- Revise basic concepts of acids, bases, ions and concentration.
- Use simple daily-life analogies for dynamic equilibrium.
- Provide step-by-step formulas and solved examples.
- Give separate practice worksheets for:
- K_c and K_p
- pH and pOH
- K_a and K_b
- K_{sp}
- Conduct short revision quizzes.
- Use peer learning and group support.
- Provide individual attention to students needing additional help.

-

- **11. Assessment**

- **Oral Assessment**

- What is dynamic equilibrium?
- What is meant by K_c ?
- State Le Chatelier's principle.
- What is pH?
- What is a buffer solution?

- **Written Assessment**

- Define chemical equilibrium with an example.
- Write the expression for K_c for:

- $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$
- Explain Le Chatelier's principle.
- Differentiate between strong and weak electrolytes.
- Calculate pH when $[\text{H}^+]$ is given.
- Explain common ion effect.
- Define solubility product.

• 12. Homework

- Learn important definitions and formulae.
- Solve numerical problems based on K_c , K_p , pH and K_a .
- Prepare a flowchart showing the relationship between **K_a , K_b , K_w , pH and pOH**.
- Find two real-life applications of chemical equilibrium.
- **Blackboard Summary**
- **Chemical Equilibrium $\rightarrow K_c, K_p \rightarrow$ Le Chatelier's Principle $\rightarrow$ Ionic Equilibrium $\rightarrow K_a, K_b \rightarrow K_w \rightarrow$ pH/pOH $\rightarrow$ Buffer $\rightarrow$ Common Ion Effect $\rightarrow K_{sp}$.**

• Chapter:7

• Redox Reactions

- MONTH-NOVEMBER
- Duration: 3–4 periods (40–45 minutes each)

• 1. Objectives

- By the end of the lesson, students will be able to:
- Define **oxidation and reduction**.
- Explain redox reactions in terms of **oxygen, hydrogen, electrons and oxidation number**.
- Identify the **oxidising agent and reducing agent**.
- Calculate the **oxidation number** of elements in compounds and ions.
- Identify oxidation and reduction in a chemical reaction.
- Balance redox reactions using the **oxidation-number method** and **ion-electron method**.
- Understand the applications of redox reactions in everyday life and industry.

- Develop logical reasoning and numerical problem-solving skills.

-

- **2. Previous Knowledge / Entry Behaviour**

- The teacher will ask:
- What is an atom and an ion?
- What are cations and anions?
- What is an electron?
- What happens when an atom loses or gains electrons?
- What is meant by a chemical reaction?
- Can you give an example of a reaction involving oxygen?
- **Expected response:** Students recall basic concepts of atoms, ions, electrons, chemical reactions and valency.

-

- **3. Innovative Methods**

- Brainstorming
- Demonstration method
- Question–answer method
- Think–Pair–Share
- Group discussion
- Concept mapping
- Activity-based learning
- ICT/Smart Board animations
- Problem-solving approach
- Real-life examples

- **Suggested Activity**

- Write:
- $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$
- Ask students:
- **"Which element loses electrons and which gains electrons?"**
- This helps students discover the concept of oxidation and reduction through electron transfer.

-

- **4. Procedure**

- **A. Introduction – 5 minutes**

- Begin with everyday examples:
- Rusting of iron
- Burning of fuels
- Respiration
- Corrosion
- Batteries
- Ask:
- **"What is common among all these processes?"**
- Introduce the concept of **oxidation-reduction (redox) reactions**.

- ---

- **B. Concept of Oxidation and Reduction – 15 minutes**

- Explain oxidation in terms of:
- Addition of oxygen
- Removal of hydrogen
- Loss of electrons
- Increase in oxidation number
- Explain reduction in terms of:
- Removal of oxygen
- Addition of hydrogen
- Gain of electrons
- Decrease in oxidation number
- Example:
- $\text{Zn} \rightarrow \text{Zn}^{2+} + 2\text{e}^-$

- **Oxidation**

- $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$

- **Reduction**

- ---

- **C. Oxidising and Reducing Agents – 10 minutes**

- Explain:

- **Oxidising agent:** A substance that causes oxidation and itself gets reduced.
- **Reducing agent:** A substance that causes reduction and itself gets oxidised.
- Example:
- $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$
- $\text{Zn} \rightarrow$ Reducing agent
- $\text{Cu}^{2+} \rightarrow$ Oxidising agent
- Students identify the agents in given reactions.

• **D. Oxidation Number – 20 minutes**

- Discuss:
- Meaning of oxidation number
- Rules for assigning oxidation numbers
- Oxidation number of free elements
- Oxidation number of oxygen and hydrogen
- Oxidation number in ions
- Calculation of oxidation number in compounds
- Example:
- Find the oxidation number of Mn in KMnO_4 .
- $(+1) + x + 4(-2) = 0 \quad x = +7$
- Students solve similar examples individually.

• **E. Balancing Redox Reactions – 20 minutes**

- Introduce:
- **Oxidation Number Method**
- **Ion-Electron Method**
- Demonstrate the steps on the board.
- Students work in pairs to balance selected redox equations.

• **5. Participation of Students**

- Students will:
- Participate in brainstorming.

- Identify oxidation and reduction in reactions.
- Calculate oxidation numbers.
- Identify oxidising and reducing agents.
- Work in pairs/groups.
- Balance redox equations.
- Present solutions on the board.
- Participate in quizzes and discussions.
- Relate redox reactions to daily-life examples.

-

- **6. Integration with Other Domains**

- **Physics**

- Electric current
- Electron transfer
- Electrochemical cells

- **Biology**

- Cellular respiration
- Photosynthesis
- Oxidation of food molecules

- **Mathematics**

- Algebraic equations
- Balancing calculations
- Ratios

- **Environmental Science**

- Corrosion
- Atmospheric oxidation
- Pollution and combustion

- **Industrial Chemistry**

- Metallurgy
- Batteries
- Extraction and refining of metals

- **Information Technology**

- Digital animations of electron transfer
- Interactive oxidation-number activities
- Smart Board presentations

-

• **7. Learning Outcomes**

- After completion of the chapter, students will be able to:
- Define oxidation and reduction.
- Explain redox reactions using electron transfer.
- Identify oxidising and reducing agents.
- Calculate oxidation numbers.
- Identify oxidised and reduced species.
- Balance redox reactions by suitable methods.
- Apply redox concepts to chemical and biological processes.
- Solve numerical and conceptual questions confidently.

-

• **8. Resources / Teaching Aids**

- Chemistry textbook
- Blackboard/Whiteboard
- Smart Board/Projector
- Periodic table
- Oxidation-number chart
- Molecular models
- Reaction cards
- Worksheets
- Laboratory apparatus
- Digital animations/videos

-

• **9. Co-Scholastic Activities**

• **Redox Reaction Quiz**

- Group activity: "Find the Oxidising and Reducing Agent"
- Poster: "**Redox Reactions in Everyday Life**"

- Oxidation-number puzzle
- Reaction-balancing competition
- Science club presentation on **batteries and corrosion**
- Concept-map preparation

- **10. Remedial Teaching**

- For students who need additional support:
- Revise atoms, ions and electron transfer.
- Use simple examples before introducing complex reactions.
- Provide an oxidation-number rules chart.
- Practise one type of problem at a time.
- Give step-by-step worksheets for balancing equations.
- Conduct short oral quizzes.
- Use peer learning.
- Provide individual guidance and repeated practice.

- **11. Assessment**

- **Oral Assessment**

- What is oxidation?
- What is reduction?
- Define oxidising agent.
- Define reducing agent.
- What is oxidation number?
- What is a redox reaction?

- **Written Assessment**

- Define oxidation and reduction in terms of electron transfer.
- Identify the oxidising and reducing agents in:
 - $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$
- Find the oxidation number of Mn in KMnO_4 .
- Find the oxidation number of Cr in $\text{K}_2\text{Cr}_2\text{O}_7$.
- Balance a given redox reaction using the oxidation-number method.

- ---
- **12. Homework**
- Learn the rules for assigning oxidation numbers.
- Identify oxidising and reducing agents in five given reactions.
- Calculate oxidation numbers of selected elements.
- Practise balancing redox reactions using both methods.
- Write five examples of redox reactions from everyday life.

- ---
- **Blackboard Summary**
- **Redox Reaction → Oxidation + Reduction → Electron Transfer → Oxidation Number → Oxidising Agent + Reducing Agent → Balancing Redox Reactions → Applications**

-
-

- **Chapter: 8**
- **Some Basic Concepts of Organic Chemistry**
- **MONTH-NOVEMBER/DECEMBER**
- **Duration: 5–6 periods (40–45 minutes each)**

- ---
- **1. General Objectives**
- Students will:
- Develop an interest in Organic Chemistry.
- Understand the special nature of carbon compounds.
- Develop skills in representing organic compounds using structural formulae.
- Understand the basic principles used for classification and nomenclature.
- Develop logical reasoning and problem-solving skills.

- ---
- **2. Specific Learning Objectives**
- By the end of the lesson, students will be able to:
- Define **Organic Chemistry**.
- Explain the **tetravalency and catenation property of carbon**.
- Understand different types of carbon-carbon bonds.

- Classify organic compounds.
- Identify **functional groups**.
- Explain homologous series.
- Write and identify different structural representations.
- Understand **IUPAC nomenclature** of simple organic compounds.
- Identify structural and geometrical isomerism at a basic level.
- Explain basic concepts of **electronic displacement effects**.
- Understand the basic idea of **reaction intermediates**.
- Identify electrophiles and nucleophiles.
- Explain different types of organic reactions.

• **3. Previous Knowledge / Entry Behaviour**

- The teacher will ask:
- What is an atom?
- What is valency?
- What is a covalent bond?
- What is the electronic configuration of carbon?
- Why does carbon form four bonds?
- Can you name compounds such as methane, ethane and ethanol?
- This will connect previous knowledge with the new chapter.

• **4. Teaching Methods**

- Question–Answer Method
- Discussion Method
- Demonstration Method
- Activity-Based Learning
- Problem-Solving Method
- Group Discussion
- Think–Pair–Share
- Concept Mapping
- ICT/Smart Board-based learning

- ---
- **5. Teaching-Learning Process**
- **Period 1: Introduction to Organic Chemistry and Carbon**
- **Introduction**
- Begin with familiar substances:
- Petrol
- Cooking gas
- Sugar
- Alcohol
- Plastics
- Medicines
- Proteins
- Ask:
- **"What element is common to most of these substances?"**
- Introduce **Organic Chemistry**.
- **Topics**
- Meaning and scope of Organic Chemistry
- Historical background
- Tetravalency of carbon
- Catenation
- Covalent bonding
- Classification of carbon atoms:
- Primary (1°)
- Secondary (2°)
- Tertiary (3°)
- Quaternary (4°)
- **Student Activity**
- Students draw the structure of:
- CH₄, C₂H₆, C₃H₈
- and identify the bonds present.
- ---

- **Period 2: Classification of Organic Compounds**
- **Topics**
- Classification based on:
 - Open-chain compounds
 - Closed-chain compounds
 - Saturated compounds
 - Unsaturated compounds
 - Homocyclic compounds
 - Heterocyclic compounds
 - Aromatic compounds
 - Aliphatic compounds
- **Activity**
- Give students structures of different compounds and ask them to classify them into appropriate groups.
- sp^2
- trigonal planar · 120° · 1 unhybridized p orbital
- C
- Hybrid orbitals
- p orbital
- $C=C$ 1 σ + 1 π
- σ overlap
- π overlap
- sp^2
- trigonal planar · 120° · 1 unhybridized p orbital
- C
- Hybrid orbitals
- p orbital
- $C=C$ 1 σ + 1 π
- σ overlap
- π overlap
- CCC

- sp³sp³sp³sp²sp²sp²
- sp³sp³sp³sp²sp²sp²
- Give feedback

- **Period 3: Functional Groups and Homologous Series**

- Important functional groups:

- **Homologous Series**

- **Activity**

- **Period 4: IUPAC Nomenclature**

- Teach the basic steps:

- Select the longest carbon chain.
- Number the chain.
- Identify substituents.
- Identify the functional group.
- Assign appropriate suffix.
- Write the complete IUPAC name.
- **Examples**
- CH₃-CH₃
- **Ethane**
- CH₃-CH₂-OH
- **Ethanol**
- CH₃-CH₂-CH₂-OH
- **Propan-1-ol**
- **Student Activity**
- Give students 5–10 structures and ask them to write their IUPAC names.

• **Period 5: Isomerism and Electronic Effects**

- **Isomerism**
- Introduce:
- **Isomers:** Compounds having the same molecular formula but different arrangements of atoms.
- Discuss basic types:
- Chain isomerism
- Position isomerism
- Functional isomerism
- Geometrical isomerism
- Example:
- C₄H₁₀
- can exist as different structural arrangements.
- **Electronic Effects**
- Introduce the basic concepts:

- Inductive effect
- Electromeric effect
- Resonance
- Hyperconjugation
- Focus on understanding rather than memorisation.

- **Period 6: Organic Reactions and Reaction Intermediates**

- **Topics**

- Types of organic reactions:

- Substitution
- Addition
- Elimination
- Rearrangement
- Oxidation
- Reduction

- **Reaction Intermediates**

- Introduce:

- Carbocation
- Carbanion
- Free radical

- **Electrophiles and Nucleophiles**

- **Electrophile:** Electron-deficient species that accepts an electron pair.

- **Nucleophile:** Electron-rich species that donates an electron pair.

- **Activity**

- Students classify given species as:

- **Electrophile / Nucleophile**

- **6. Participation of Students**

- Students will:
- Participate in brainstorming.
- Draw organic structures.

- Identify carbon atoms and bonds.
- Classify organic compounds.
- Identify functional groups.
- Construct homologous series.
- Name organic compounds using IUPAC rules.
- Identify isomers.
- Classify electrophiles and nucleophiles.
- Participate in group activities and quizzes.
- Solve structure-based questions on the board.

-

- **7. Integration with Other Domains**

- **Biology**

- Carbohydrates
- Proteins
- Lipids
- Nucleic acids
- Organic molecules in living organisms

- **Environmental Science**

- Hydrocarbon pollution
- Fossil fuels
- Green chemistry
- Biodegradable organic compounds

- **Physics**

- Molecular structure
- Electrons
- Bond formation

- **Mathematics**

- Structural formulae
- Molecular formulae
- Carbon-chain numbering

- **Information Technology**

- 3-D molecular models
- Digital molecular visualisation
- Interactive nomenclature exercises
- Smart Board presentations

• **8. Teaching-Learning Resources**

- Chemistry textbook
- Periodic table
- Molecular models
- Structural formula charts
- Functional-group chart
- IUPAC nomenclature worksheet
- Blackboard/Whiteboard
- Smart Board/Projector
- Organic chemistry animations
- Practice worksheets

• **9. Co-Scholastic Activities**

• **Activity 1 – Functional Group Hunt**

- Students identify functional groups from structures displayed by the teacher.

• **Activity 2 – IUPAC Naming Competition**

- Groups compete to correctly name organic structures.

• **Activity 3 – Build the Molecule**

- Using molecular models, students construct:

- Methane
- Ethane
- Ethene
- Ethyne

• **Activity 4 – Organic Chemistry Around Us**

- Students prepare a list of organic substances found at home.

• **Activity 5 – Concept Map**

- Students prepare a concept map:
- **Carbon → Catenation → Organic Compounds → Functional Groups → Homologous Series → Nomenclature → Isomerism → Organic Reactions**

- **10. Remedial Teaching**

- For students who require additional support:
- Revise valency and covalent bonding.
- Start with simple carbon chains.
- Use colour-coded molecular models.
- Provide a functional-group reference chart.
- Practise IUPAC nomenclature step by step.
- Give simple structures before introducing branched chains.
- Use peer learning.
- Conduct short daily quizzes.
- Provide additional worksheets for nomenclature and isomerism.

- **11. Assessment**

- **Oral Questions**

- What is Organic Chemistry?
- Why is carbon able to form a large number of compounds?
- What is catenation?
- What is a functional group?
- What is a homologous series?
- What are isomers?
- What is an electrophile?
- What is a nucleophile?

- **Written Assessment**

- Explain tetravalency and catenation of carbon.
- Classify organic compounds with suitable examples.
- Identify the functional groups in given compounds.
- Write IUPAC names of given structures.

- Draw structures from given IUPAC names.
- Explain different types of isomerism.
- Differentiate between electrophiles and nucleophiles.
- Explain substitution, addition and elimination reactions.

- **12. Homework**

- Learn important functional groups.
- Prepare a chart of common functional groups.
- Write IUPAC names of 15 given organic compounds.
- Draw structures for 15 given IUPAC names.
- Practise questions on homologous series.
- Prepare examples of different types of isomerism.
- Write examples of electrophiles and nucleophiles.
- Prepare a one-page concept map of **Basic Organic Chemistry**.

- **13. Learning Outcomes**

- | • Learning Outcome | • Assessment |
|---|---------------------------------------|
| • Explain tetravalency and catenation | • Oral/Written |
| • Classify organic compounds | • Worksheet |
| • Identify functional groups | • Activity |
| • Explain homologous series | • Class exercise |
| • Apply IUPAC nomenclature | • Numerical/Structure-based questions |
| • Identify isomers | • Written assessment |
| • Explain electronic effects | • Conceptual questions |
| • Identify electrophiles and nucleophiles | • Quiz |
| • Recognise types of organic reactions | • Reaction-based questions |

- **14. Blackboard Summary**

- **Basic Organic Chemistry**

- Carbon → Tetravalency + Catenation → Organic Compounds → Classification → Functional Groups → Homologous Series → IUPAC Nomenclature → Isomerism → Electronic Effects → Electrophiles & Nucleophiles → Organic Reactions

- Key Terms

- Tetravalency | Catenation | Functional Group | Homologous Series | IUPAC Nomenclature | Isomerism | Electrophile | Nucleophile | Carbocation | Carbanion | Free Radical

-
-

- Chapter:9

• Hydrocarbons

- MONTH-DECEMBER/JANUARY

- Duration: 6–8 periods (40–45 minutes each)

-

• 1. General Objectives

- Students will:
- Develop an understanding of hydrocarbons and their importance.
- Relate the structure of hydrocarbons to their physical and chemical properties.
- Understand different types of hydrocarbons and their reactions.
- Develop skills in writing structural formulae and chemical equations.
- Apply concepts of organic chemistry to fuels and everyday materials.

-

• 2. Specific Learning Objectives

- By the end of the chapter, students will be able to:
- Define **hydrocarbons**.
- Classify hydrocarbons into **alkanes, alkenes, alkynes and aromatic hydrocarbons**.
- Explain the structure and bonding in hydrocarbons.
- Write general formulae of different classes of hydrocarbons.
- Apply **IUPAC nomenclature** to hydrocarbons.
- Explain the preparation and properties of alkanes, alkenes and alkynes.
- Understand important chemical reactions of hydrocarbons.
- Explain the concept of **isomerism** in hydrocarbons.
- Understand the structure and properties of benzene.

- Explain **aromaticity** at a basic level.
- Understand the environmental importance of hydrocarbons and their combustion.

-

• **3. Previous Knowledge / Entry Behaviour**

- The teacher will ask:
- What is Organic Chemistry?
- What is tetravalency of carbon?
- What is catenation?
- What is a covalent bond?
- What are saturated and unsaturated compounds?
- What is a functional group?
- Can you write the structures of methane, ethene and ethyne?

-

• **4. Teaching Methods**

- Question–Answer Method
- Discussion Method
- Demonstration Method
- Activity-Based Learning
- Problem-Solving Method
- Group Discussion
- Think–Pair–Share
- Molecular modelling
- ICT/Smart Board-based learning

-

• **5. Teaching-Learning Process**

• **Period 1: Introduction and Classification of Hydrocarbons**

• **Introduction**

- Start with everyday examples:
- LPG
- CNG
- Petrol

- Diesel
- Natural gas
- Paraffin wax
- Ask:
- **“What is common among these substances?”**
- Introduce the term **hydrocarbon**.
- **Topics**
- Definition of hydrocarbons
- Sources of hydrocarbons
- Classification:
- Saturated hydrocarbons
- Unsaturated hydrocarbons
- Aromatic hydrocarbons
- **Classification Chart**
- **Hydrocarbons**
- → **Aliphatic**
- Alkanes
- Alkenes
- Alkynes
- → **Aromatic**
- Benzene and its derivatives
- **Student Activity**
- Students classify the following:
- CH₄, C₂H₄, C₂H₂, C₆H₆

-
- **Period 2: Alkanes**
 - **Topics**
 - Definition of alkanes
 - General formula:
 - C_nH_{2n+2}
 - Structure and bonding

- Nomenclature
- Isomerism in alkanes
- Preparation of alkanes
- **Important Methods**
- Hydrogenation of alkenes/alkynes
- Wurtz reaction
- Decarboxylation
- **Chemical Properties**
- Combustion
- Halogenation
- Substitution reactions
- **Activity**
- Students construct models of:
- **Methane → Ethane → Propane → Butane**
- sp^2
- trigonal planar · 120° 1 unhybridized p orbital
- C
- Hybrid orbitals
- p orbital
- $C=C$ $\sigma + 1 \pi$
- σ overlap
- π overlap
- sp^2
- trigonal planar · 120° 1 unhybridized p orbital
- C
- Hybrid orbitals
- p orbital
- $C=C$ $\sigma + 1 \pi$
- σ overlap
- π overlap
- CCC

- **Topics**

- Definition
- General formula:
- C_nH_{2n-2}
- Triple bond
- sp hybridisation
- Structure of ethyne
- Nomenclature

- **Preparation**

- Preparation of ethyne and other alkynes.

- **Chemical Properties**

- Hydrogenation
- Halogenation
- Hydrohalogenation
- Hydration
- Oxidation

- **Activity**

- Students compare:

- | | | |
|-----------------|-----------------|-----------------|
| • Alkane | • Alkene | • Alkyne |
| • Single bond | • Double bond | • Triple bond |
| • Saturated | • Unsaturated | • Unsaturated |
| • C_nH_{2n+2} | • C_nH_{2n} | • C_nH_{2n-2} |

- ---

- **Period 5: Aromatic Hydrocarbons – Benzene**

- **Topics**

- Structure of benzene
- Kekulé structure
- Resonance
- Stability of benzene
- Aromaticity

- Nomenclature of benzene derivatives
- **Chemical Properties**
- Mainly **electrophilic substitution reactions**:
- Nitration
- Halogenation
- Sulphonation
- Friedel–Crafts alkylation
- Friedel–Crafts acylation
- **Activity**
- Students draw the structure of benzene and identify its alternating representation/resonance concept.

- **Period 6: Preparation and Chemical Reactions – Revision**
- Students revise:
- **Alkanes**
- **Substitution**
- **Alkenes**
- **Addition**
- **Alkynes**
- **Addition**
- **Aromatic Hydrocarbons**
- **Electrophilic substitution**
- Students complete a reaction chart showing the major reactions of each class.

- **Period 7: Petroleum, Fuels and Environmental Chemistry**
- **Topics**
- Natural gas
- Petroleum
- Coal
- LPG
- CNG

- Hydrocarbons as fuels
- Combustion of hydrocarbons
- Incomplete combustion
- Air pollution
- Greenhouse gases
- Sustainable fuel use
- **Discussion**
- **“Why is CNG considered a cleaner fuel than many conventional hydrocarbon fuels?”**
- Students discuss advantages and disadvantages of different fuels.

• **Period 8: Revision and Assessment**

• **Revision Activities**

- Concept map
- Reaction completion
- IUPAC naming quiz
- Structure-identification activity
- MCQ quiz
- Group problem-solving

• **6. Participation of Students**

- Students will:
- Identify and classify hydrocarbons.
- Draw structural formulae.
- Construct molecular models.
- Write IUPAC names.
- Identify saturated and unsaturated compounds.
- Complete chemical reactions.
- Compare alkanes, alkenes and alkynes.
- Discuss benzene and aromaticity.
- Participate in group activities and quizzes.
- Solve numerical and conceptual questions.

- ---
- **7. Integration with Other Domains**
- **Physics**
- Molecular structure
- Energy released during combustion
- Fuels and energy resources
- **Biology**
- Organic molecules
- Lipids and biological hydrocarbons
- **Environmental Science**
- Air pollution
- Greenhouse effect
- Fossil fuels
- Sustainable energy
- **Mathematics**
- General formulae
- Molecular formula calculations
- Structural representations
- **Geography/Economics**
- Petroleum resources
- Natural gas
- Energy resources and their distribution

- ---
- **8. Teaching-Learning Resources**
- Chemistry textbook
- Periodic table
- Molecular models
- Structural formula charts
- Reaction charts
- Blackboard/Whiteboard
- Smart Board/Projector

- Hydrocarbon worksheets
- Ball-and-stick models
- Educational animations

-

- **9. Co-Scholastic Activities**

- **Activity 1 – Hydrocarbon Classification**

- Students classify different compounds as:

- **Alkane / Alkene / Alkyne / Aromatic**

- **Activity 2 – Molecular Model Building**

- Students build models of:

- Methane

- Ethane

- Ethene

- Ethyne

- Benzene

- **Activity 3 – Reaction Card Game**

- Students match:

- **Reactant → Reagent → Product**

- **Activity 4 – Fuel Awareness Poster**

- Topic:

- **“Hydrocarbons as Fuels: Benefits and Environmental Impact”**

- **Activity 5 – IUPAC Naming Competition**

- Groups compete to correctly name given hydrocarbon structures.

-

- **10. Remedial Teaching**

- For students requiring additional support:

- Revise carbon valency and covalent bonding.

- Use molecular models to explain structures.

- Provide a hydrocarbon classification chart.

- Practise IUPAC nomenclature step by step.

- Use colour-coded single, double and triple bonds.

- Provide reaction maps for each class.
- Begin with simple reactions before introducing multi-step reactions.
- Conduct short quizzes after each topic.

-

- **11. Assessment**

- **Oral Questions**

- What are hydrocarbons?
- What are saturated hydrocarbons?
- What are unsaturated hydrocarbons?
- What is the general formula of alkanes?
- What is the general formula of alkenes?
- What is the general formula of alkynes?
- What is sp^3 hybridisation?
- What is sp^2 hybridisation?
- What is sp hybridisation?
- What is aromaticity?

- **Written Assessment**

- Classify hydrocarbons with suitable examples.
- Write the general formulae of alkanes, alkenes and alkynes.
- Write IUPAC names of given hydrocarbons.
- Explain the preparation of alkanes.
- Write important chemical reactions of alkenes.
- Explain the structure of benzene.
- Explain electrophilic substitution reactions of benzene.
- Differentiate between alkanes, alkenes and alkynes.

-

- **12. Homework**

- Prepare a classification chart of hydrocarbons.
- Write the general formulae of different classes.
- Practise IUPAC nomenclature of 15 hydrocarbons.
- Write important reactions of alkanes, alkenes and alkynes.

- Draw structures of different isomers of butane.
- Prepare a short note on benzene.
- Write the uses of hydrocarbons as fuels.
- Prepare a poster on “**Hydrocarbons and Environmental Pollution.**”

- **13. Learning Outcomes**

- | • Learning Outcome | • Assessment |
|--|------------------------|
| • Define hydrocarbons | • Oral questioning |
| • Classify hydrocarbons | • Worksheet |
| • Identify saturated/unsaturated compounds | • Activity |
| • Write IUPAC names | • Class exercise |
| • Explain structures and hybridisation | • Diagram/model |
| • Write preparation methods | • Written test |
| • Explain chemical reactions | • Reaction worksheet |
| • Understand benzene and aromaticity | • Conceptual questions |
| • Relate hydrocarbons to fuels | • Group discussion |
| • Explain environmental effects | • Poster/presentation |

- **14. Blackboard Summary**

- **HYDROCARBONS**

- **Hydrocarbons**

- → **Aliphatic**
- → Alkanes — C_nH_{2n+2} — **Single bond** — **Substitution**
- → Alkenes — C_nH_{2n} — **Double bond** — **Addition**
- → Alkynes — C_nH_{2n-2} — **Triple bond** — **Addition**
- → **Aromatic Hydrocarbons**
- → Benzene — **Electrophilic Substitution**

- **Key Concepts**

- **Classification → Nomenclature → Structure → Hybridisation → Preparation → Chemical Properties → Reactions → Benzene → Fuels → Environmental Impact**

