Appendix A

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Appendix A-4b: SI Values of Summative Tests
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MODULE I

ATOMS AND MOLECULES

Content Sequence:

Unit I: Laws of chemical combination
- Law of Conservation of Mass
- Law of Constant Proportion
- Numericals to verify Laws of Chemical Combination
- Dalton’s Atomic Theory
- Explanation of laws of Chemical Combination on the basis of Dalton’s Atomic Theory
- Drawback of Dalton’s Atomic Theory

Unit II: Atoms and Molecules
- Meaning of Atom
- Symbol of Element
- Atomic Mass of Element
- Molecules; Molecules of Element and Compound
- Atomicity
- Calculation of Molecular Mass of Compound
- Ion: Cations and Anions
- Formula Unit

Enduring Understanding
Matter is composed of very small particles called pramanu. John Dalton called them as “Atom”. He proposed an atomic theory which states that Atoms are the smallest particle of matter that cannot be divided further. This theory is based on experimentally verified laws of chemical combination. Atom of element is represented by a unique symbol and has a definite mass called atomic mass. Atoms can exist in two ways- molecules and ions to gain stability.

Behavioural Objectives of the Module: Listed in Table 3.2 in Chapter 3

DAY 1
Teacher will hold pretest of Summative Test I followed by brief introduction of the module I
DAY 2
UNIT 1: LAWS OF CHEMICAL COMBINATION

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Laws of chemical combination
- Law of conservation of mass
- Law of constant proportions
- Numericals to verify laws of chemical combination

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. The building blocks of matter are called _________.
2. Hydrogen and oxygen always combine in the ratio of ________ by mass to form water.
3. Atoms are called building blocks of matter because ________________.
4. Law of conservation of mass states that during chemical reaction ________________

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD:

Indian Philosopher, Maharishi Kannad, was the first person to propose that matter is proposed of small particles called pramanu. John Dalton called them as atom.

Law of Chemical Combination: law of chemical combination are the experimental laws which have been formulated by scientists after performing a number of experiments.

Law of Conservation of Mass: Propounded By: Lavoisier in 1774

Matter can neither be created nor be destroyed in a chemical reaction.
Activity: Experiment to verify Law of conservation of mass through animation
To prove that there is no change in mass during chemical reaction

Step 1: Take a conical flask filled with 5ml of Sodium carbonate solution (Na₂SO₃). Take 5 ml of copper solution (CuSO₄) in ignition tube.
Step 2: Weigh the conical flask and the ignition tube with physical balance.
Step 3: Tilt the content of ignition tube in the conical flask and let the two solution mix. Now weigh the mass of content in conical flask with physical balance.
Observation: The mass of flask and the content donot change after reaction.
Conclusion: There is no change in the mass during chemical reaction.

Teacher will solve numerical related to law of conservation of mass through traditional teaching
Numerical: 100 gms of calcium carbonate when heated, decomposes completely into 56 gms of calcium oxide and 44gms of carbondioxide. Show that this data verifies the law of conservation of mass.

Solution: Mass of reactant, CaCO₃ = 100g
  - Mass of CaO = 56 g
  - Mass of CO₂ = 44 g

Total mass of products = Mass of CaO + Mass of CO₂
                      = 56gms + 44g = 100g

Mass of reactant (100g) = Mass of products (100g)
Therefore, there is no change in mass during chemical reaction.

Law of Constant Proportion: Proposed by: proust in 1779
A chemical compound always consists of same elements combined together in the same proportion by weight. e.g. Water is made up of hydrogen and oxygen, combined together in 1:8 proportion by mass.
Teacher will solve numerical related to law of constant proportion through traditional teaching

Numerical 1: Hydrogen and oxygen combine in the ratio of 1:8 by mass to form water. What mass of oxygen gas would be required to react completely with 3 g of hydrogen gas?

Solution: we Know that hydrogen and oxygen always combine in the fixed ratio of 1:8 by mass. This means that:

\[
\begin{align*}
1 \text{ g of hydrogen gas requires} &= 8 \text{ g of oxygen gas} \\
3 \text{ g of hydrogen gas requires} &= 8 \times 3 \text{ g of oxygen gas} \\
&= 24 \text{ g of oxygen gas}
\end{align*}
\]

Thus, 24 g of oxygen gas would be required to react completely with 3 g of hydrogen gas.

GROUP DISCUSSION: After the content presentation, students will be engaged in group discussion using Three Minute Review cooperative strategy

ASSIGNMENT: In an experiment 1.288 g of copper oxide was obtained from 1.03 g of copper. In another experiment 3.672 g of copper oxide gave, on reduction 2.938 g of copper. Show that these figures verify the law of constant proportion.

DAY 3

UNIT 1: LAWS OF CHEMICAL COMBINATION

WARM UP: To establish rapport between teacher and student
List of objectives for the topic to help focus the learning:

- Postulates of Dalton’s Atomic theory
- Explanation of laws of chemical combination in terms of Dalton’s Atomic theory
- Draw back of Dalton’s Atomic theory
Hybrid Instructional Modules

**PREVIOUS KNOWLEDGE TESTING:** To stimulate the students of what they already know about the topic

1. Law of constant proportion states that ________________________________.
2. Which of the statement regarding Dalton’s atomic theory are correct:
   (i) Atoms are tiny indivisible particles
   (ii) Atoms of an element can be created, destroyed and converted to that of another element
   (iii) Atoms of different elements have different masses
   (iv) Atoms does not combine in simple whole number ratio.

**Hybrid Instructional Package: Teaching-Learning Process**

Following content will be presented through CD:

**DALTON’S ATOMIC THEORY:** proposed by John Dalton in the year 1808

Postulates:
1. All matter is made up of very tiny particles called atoms
2. Atoms are indivisible particles
3. All the atoms of a given element are identical in mass and chemical properties
4. Atoms of different elements have different masses and chemical properties
5. During chemical reaction, atoms of different elements combine in small whole numbers to form compounds.

**GROUP DISCUSSION:** Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy

- Critically analyse and explain the laws of chemical combination in accordance to Dalton’s atomic theory

**GROUP DISCUSSION:** Following Content will be discussed in group discussion using Round Table or Rally Table Cooperative Strategy

- Enlist various draw backs of Dalton’s Atomic theory

**ASSIGNMENT.** Write down various draw backs of Dalton’s atomic theory in your notebooks and give justification for your answer.

**DAY 4**

**EVALUATION:** Students will individually appear in formative test 1 for unit 1: Laws of Chemical Combination using **STAD (Student Teams-Achievement Divisions) cooperative strategy**
**ANNOUNCEMENT:** Teacher will distribute the handouts of table containing symbols and atomic mass of various elements and ask them to learn it for the Inter group Quiz related to the topic, which is going to be held tomorrow.

**DAY 5**

**UNIT 2: ATOMS AND MOLECULES**

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Meaning of Atom
- Symbol of Element
- Atomic mass of an element
- Relative atomic mass of element

**PREVIOUS KNOWLEDGE TESTING:** To stimulate the students of what they already know about the topic

1. Atom is defined as ____________________________.
2. Size of an atom is expressed in ________.
3. Atom can exist in ________ and ________ form.
4. Write symbols for the following:
   - Hydrogen
   - Nitrogen
   - Neon
   - Carbon
   - Calcium
   - Iron

**Hybrid Instructional Package: Teaching- Learning Process**

Following content will be presented through CD:

**ATOM:** Atom is defined as the smallest particle of an element that can take part in a chemical reaction. Atoms are very, very small in size that we cannot see them under the most powerful optical microscope. The size of atom is indicated by its radius which is called ‘atomic radius’. Atomic radius is measured in ‘nanometers’- nm.

**Relationship between nanometer and metre:**

\[1 \text{ nanometre} = 10^{-9} \text{ metre}\]

\[1 \text{ nm} = 10^{-9} \text{ m}\]
SYMBOLS OF ELEMENTS:

The symbol of an element is an abbreviation (Short name) for the full name of the element.

Dalton was the first scientist to use the symbols to represent element in short way.

Symbols used by Dalton's

<table>
<thead>
<tr>
<th>Substance</th>
<th>Symbol</th>
<th>Substance</th>
<th>Symbol</th>
<th>Substance</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>H</td>
<td>Carbon</td>
<td>C</td>
<td>Oxygen</td>
<td>O</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>P</td>
<td>Sulphur</td>
<td>S</td>
<td>Iron</td>
<td>I</td>
</tr>
<tr>
<td>Copper</td>
<td>C</td>
<td>Lead</td>
<td>L</td>
<td>Silver</td>
<td>S</td>
</tr>
<tr>
<td>Gold</td>
<td>G</td>
<td>Plutina</td>
<td>P</td>
<td>Mercury</td>
<td>Hg</td>
</tr>
</tbody>
</table>

Modern Symbols of element: Modern symbol of element was proposed by J.J Berzelius of Sweden. The symbol of an element is the “first letter” or the “first letter and another letter” of the English name or Latin name of the element.

Common names, symbols and symbol sources of some typical elements.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Symbol source</th>
<th>Symbol</th>
<th>Common Name</th>
<th>Symbol source</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>Hydrogenium</td>
<td>H</td>
<td>Calcium</td>
<td>Calx</td>
<td>Ca</td>
</tr>
<tr>
<td>Carbon</td>
<td>Carbonium</td>
<td>C</td>
<td>Chromium</td>
<td>Chrom</td>
<td>Cr</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>Nitrogenium</td>
<td>N</td>
<td>Krypton</td>
<td>Kryptos</td>
<td>Kr</td>
</tr>
<tr>
<td>Oxygen</td>
<td>Oxygenium</td>
<td>O</td>
<td>Antimony</td>
<td>Sibium</td>
<td>Sb</td>
</tr>
<tr>
<td>Sodium</td>
<td>Natrium</td>
<td>Na</td>
<td>Silicoen</td>
<td>Silex</td>
<td>Si</td>
</tr>
<tr>
<td>Potassium</td>
<td>Kalium</td>
<td>K</td>
<td>Mercury</td>
<td>Hydrargyrum</td>
<td>Hg</td>
</tr>
<tr>
<td>Copper</td>
<td>Cuprum</td>
<td>Cu</td>
<td>Iron</td>
<td>Ferrum</td>
<td>Fe</td>
</tr>
</tbody>
</table>

IUPAC: International Union of Pure and Applied Chemistry. The names and symbols of all newly discovered elements are approved by the IUPAC.
ATOMIC MASS OF AN ELEMENT

Atomic mass unit: Earlier atomic mass unit (abbreviated as 'amu', but according to the latest IUPAC recommendations, it is now written as 'u' - unified mass) defined as mass of one carbon atom. In 1961, universally accepted atomic mass unit, carbon-12 isotope was chosen as the standard reference for measuring atomic masses.

"The mass equal to the \( \frac{1}{12} \) th of the mass of a \(^{12}\text{C}\) atom is called one atomic mass unit."

\[
1 \text{ atomic mass unit} = \frac{\text{Mass of a } ^{12}\text{C atom}}{12} = \frac{1.9924 \times 10^{-23} \text{g}}{12} = 1.66 \times 10^{-24} \text{g} = 1.66 \times 10^{-27} \text{kg}
\]

ATOMIC MASS: The atomic mass of an element is the relative mass of its atom as compared with the mass of a carbon-12 atom taken as 12 units.

<table>
<thead>
<tr>
<th>Element</th>
<th>Atomic Mass (u)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>1</td>
</tr>
<tr>
<td>Carbon</td>
<td>12</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>14</td>
</tr>
<tr>
<td>Oxygen</td>
<td>16</td>
</tr>
<tr>
<td>Sodium</td>
<td>23</td>
</tr>
<tr>
<td>Magnesium</td>
<td>24</td>
</tr>
<tr>
<td>Sulphur</td>
<td>32</td>
</tr>
<tr>
<td>Chlorine</td>
<td>35.5</td>
</tr>
<tr>
<td>Calcium</td>
<td>40</td>
</tr>
</tbody>
</table>

Relative atomic mass of an element: The relative atomic mass of an element is defined as the average relative mass of an atom of the element compared with an atom of \(^{12}\text{C}\) taken as 12u.

Thus,

\[
\text{Relative atomic mass of an element} = \frac{\text{Average mass of 1 atom of the element}}{\text{Mass of one } ^{12}\text{C atom / 12}}
\]

Relative atomic mass is a pure number, and hence it has no unit.

The relative atomic mass of an element indicates the number of times one atom of that element is heavier than \( \frac{1}{12} \) of a \(^{12}\text{C}\) atom.
GROUP DISCUSSION: After the content presentation through CD, Students will be engaged in group discussion using Three Minute Review – cooperative strategy, followed by Quiz.

RULES FOR THE QUIZ:

- The quiz is Inter-group quiz.
- Total of 10 Questions will be asked from each group. 1 mark for each correct answer and 0.5 marks are bonus for each passed question.
- There will be five individual questions followed by five group questions. One question will be asked from each member of the group.
- There are five possible points:
  - 8 to 10 out of 10 correct = 5 points
  - 6 to 7 out of 10 correct = 4 points
  - 4 to 5 out of 10 correct = 3 points
  - 2 to 3 out of 10 correct = 2 points

Note: Every member of the group receives the same score.

ASSIGNMENT: Write by learning the symbols and atomic mass for at least 30 elements in your notebooks.

DAY 6

UNIT 2: ATOMS AND MOLECULES

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Definition of molecules of element - molecules of compound
- Atomicity of various elements
- Definition of ions, cations and anions
- Calculation of formula mass of ionic compounds

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

State whether the following statements are true or false:

1. Loss of electrons by an atom gives rise to a positively charged ion.
2. Combining capacity of iron is 3
3. Negative and positive ions combine to form ionic compound
4. Gain of electron give rise to formation of the negative ion.

**Hybrid Instructional Package: Teaching-Learning Process**

Following content will be presented through PowerPoint Presentation:

**MOLECULE**

A molecule can be defined as the smallest particle of an element or a compound that is capable of an independent existence and shows all the properties of that substance.

A molecule may contain atoms of the same or different elements. Each molecule is described by its chemical formula.

**Molecules of Elements**

A molecule of an element may contain two or more than two atoms of same element.

![Molecules of Elements](image)

**Atomicity**

The number of atoms constituting a molecule is known as its **atomicity**. Atomicity of some elements are given in the table below:

<table>
<thead>
<tr>
<th>Types of Elements</th>
<th>Name</th>
<th>Atomicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Metal</td>
<td>Argon</td>
<td>Monoatomic</td>
</tr>
<tr>
<td></td>
<td>Helium</td>
<td>Monoatomic</td>
</tr>
<tr>
<td></td>
<td>氧</td>
<td>Diatomic</td>
</tr>
<tr>
<td></td>
<td>Oxygen</td>
<td>Diatomic</td>
</tr>
<tr>
<td></td>
<td>Hydrogen</td>
<td>Diatomic</td>
</tr>
<tr>
<td></td>
<td>Nitrogen</td>
<td>Diatomic</td>
</tr>
<tr>
<td></td>
<td>Chlorine</td>
<td>Tetra-atomic</td>
</tr>
<tr>
<td></td>
<td>Phosphorus</td>
<td>Poly-atomic</td>
</tr>
<tr>
<td></td>
<td>Sulphur</td>
<td></td>
</tr>
<tr>
<td>Metal</td>
<td>Sodium</td>
<td>Monoatomic</td>
</tr>
<tr>
<td></td>
<td>Iron</td>
<td>Monoatomic</td>
</tr>
<tr>
<td></td>
<td>Aluminium</td>
<td>Monoatomic</td>
</tr>
<tr>
<td></td>
<td>Copper</td>
<td>Monoatomic</td>
</tr>
</tbody>
</table>
**MOLECULES OF COMPOUNDS**

A molecule of a compound consists of two or more atoms of different elements which are joined together in a fixed ratio by chemical bonds.

For e.g. NH₃ and H₂O

![Molecules of compounds diagram](image)

The teacher will explain the following content by using traditional teaching involving students actively.

**MOLECULAR MASS OF A COMPOUND**

The molecular mass of a substance is equal to the sum of atomic masses of all the atoms present in a molecule of that substance.

**How to calculate the molecular mass of a compound**

For example, the molecular formula of calcium carbonate is (CaCO₃). Therefore

Molecular mass of CaCO₃ = (1 x Atomic mass of calcium) + (1 x Atomic mass of carbon) + (3 x Atomic mass of oxygen)

(Since, the atomic mass of calcium is 40 u, carbon 12 u and oxygen 16 u.)

= 1(Ca) + 1(C) + 3(O)

= 1(40) + 1(12) + 3(16)

= 40 + 12 + 48

= 100 u

**IONS**

An ion is an electrically charged particle which may have positive (+ve) or negative (-ve) charge. A positively charged particle (species) is called cation and negatively charged particle (species) is called anion. In the molecules of a compound, sum of the total +ve charge on cation is equal to sum of the -ve charge on anion. Due to this fact the compound is electrically neutral.
Calculation of Formula mass of ionic compound:

\[
\text{Formula mass of NaCl} = (1 \times \text{Atomic mass of Na}) + (1 \times \text{Atomic mass of Cl}) \\
= 1(23u) + 1(35.5u) \\
= 58.5u
\]

**GROUP DISCUSSION:** Teacher will ask the students to solve the following two questions by using **Numbered Head together- cooperative strategy.**

- Calculate the molecular mass of CH₃OH
- Calculate the Formula mass of Al₂O₃

**ASSIGNMENT:** Differentiate between molecule of an element and the molecule of a compound with the help of example.

**DAY 7**

**EVALUATION:** Students will individually appear in formative test 2 for unit 2: Atoms and molecules using **STAD (Student Teams-Achievement Divisions) cooperative strategy**

**DAY 8**

Teacher will take posttest of Summative Test 1
Appendix A-1 (ii)

MODULE 2
Atoms and Molecules

Content Sequence:

Unit III: Chemical formulae
- Naming of Molecular Compounds
- Concept of Valency
- Writing of Formulae of Molecular Compounds - Crossing over method
- Valency of Ion; Monovalent, Divalent and Trivalent Ion
- Naming of Ionic Compounds
- Writing of Formulae of Ionic Compounds - Crossing over method

Unit IV: Mole Concept
- Gram Atomic Mass
- Gram Molecular Mass
- Mole concept
- Numerical: Mole of Atom and Molecule

Enduring understanding

The chemical formula of the compound is a symbolic representation of its composition. The chemical formula of different can be written easily by using cross over the valencies method and following the rules. All that is needed is to learn symbols and combining capacity of the learner.

Behavioral Objectives of the Module: Listed in Table 3.2 in Chapter 3

DAY 1
Teacher will hold pretest of Summative Test II followed by brief introduction of the module.
WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Concept of chemical formulae
- Rules for naming of molecular compound
- Concept of valency
- Writing the formula by crossing-over method

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. State true or false
   (i) The combining capacity of element is known as valency.
   (ii) The chemical formula of phosphorus trichloride is $P_3Cl_5$

2. Give the valency of the following elements:
   (i) Hydrogen
   (ii) Carbon
   (iii) Iron
   (iv) Magnesium

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through power point presentation

Chemical formula:

Chemical formula of compound represents the composition of a molecule of the compound in terms of the symbol of the elements present in it.

Naming of molecular compounds: Rules:

1. The less electronegative non-metals element is written on the left hand side whereas the more electronegative non-metal is written on the right hand side
2. The first element (i.e. less electronegative non metal) keeps its name
Hybrid Instructional Modules

3. The second element (i.e. more electronegative non metal) gets the -ide suffix (ending)

4. When there are more than one atom of an element in a molecular compound then the number
   of atoms is indicated by using appropriate prefixes in the formula
   a. The first element gets a prefix if it has a subscript in the formula.
      For e.g. 1 – mono e.g. Carbon monoxide
            2 – di  e.g. Carbon dioxide
            3 – tri  e.g. Phosphorous trichloride
            4 – tetra e.g. Carbon tetra chloride
            5 – penta e.g. Phosphorous pentachloride

   Exception:
   (i) prefix ‘mono’ is not written for the first element of the formula even if it has 1 atom.
   (ii) If hydrogen is the first element in the formula then no prefix is used before the name
        ‘hydrogen’, even if it has more than one hydrogen atom for ex. H₂S is written as Hydrogen
        Sulphide and not dihydrogen sulphide

   b. The second element always gets a prefix

5. If two non-metals form just one compound, then prefixes are not used in naming such
   compounds. e.g. HCl

Examples of naming molecular compound

SO₃ : Sulphur trioxide
N₂O₃ : Dinitrogen trioxide

Valency

Valency is the combining capacity of an element. Valency can be used to find out how the atoms
of an element will combine with the atom(s) of another element to form a chemical compound. It is
defined as:

"The number of hydrogen atoms, which combine directly or indirectly with one atom
of an element, so as to form a chemical compound is called its valency."

For example - In NaCl, the valency of Na is 1, because one sodium atom combines with one chlorine
atom.

Valency of some common non-metals elements:

<table>
<thead>
<tr>
<th>Element</th>
<th>Symbol</th>
<th>Valency</th>
<th>Element</th>
<th>Symbol</th>
<th>Valency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td>H</td>
<td>1</td>
<td>Oxygen</td>
<td>O</td>
<td>2</td>
</tr>
<tr>
<td>Fluorine</td>
<td>F</td>
<td>1</td>
<td>Sulphur</td>
<td>S</td>
<td>2</td>
</tr>
<tr>
<td>Chlorine</td>
<td>Cl</td>
<td>1</td>
<td>Nitrogen</td>
<td>N</td>
<td>3</td>
</tr>
<tr>
<td>Bromine</td>
<td>Br</td>
<td>1</td>
<td>Phosphorus</td>
<td>P</td>
<td>3</td>
</tr>
<tr>
<td>Iodine</td>
<td>I</td>
<td>1</td>
<td>Carbon</td>
<td>C</td>
<td>4</td>
</tr>
</tbody>
</table>
Writing of Formula: Crossing-over of valencies method

Step 1: write the symbol of the element.

Step 2: Write the respective valency below the symbol of each element

Step 3: Cross over the valencies of combining atom.

Examples of the formula of molecular compounds

<table>
<thead>
<tr>
<th>Compound</th>
<th>Symbols with valencies</th>
<th>Cross over of valencies</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>C(^{4+}) H(^{1-})</td>
<td>C (\leftrightarrow) H</td>
<td>CH(_4)</td>
</tr>
<tr>
<td>Carbon tetrachloride</td>
<td>C(^{4+}) Cl(^{1-})</td>
<td>C (\leftrightarrow) Cl</td>
<td>CCl(_4)</td>
</tr>
</tbody>
</table>

E.g. The valency of element X is 1 and oxygen is 2. The formula of the compound will be X\(_2\)O

**GROUP DISCUSSION:** After the content presentation by the teacher, students will be engaged in group discussion using Think Pair Share Cooperative Strategy

Teacher will ask the students to solve the given questions individually in 15 min

1. Write the name of the given molecular compound:
   (a) H\(_2\)O  (b) N\(_2\)O\(_4\)  (c) ICl\(_3\)

2. If the valency of carbon is 4 and that of sulphur is 2, work out the formula of the compound formed by the combination of carbon with sulphur. What is the name of this compound?

3. Write the chemical formula for the following:
   (a) Diphosphorous pentaoxide  (b) Dinitrogen monoxide

**ANNOUNCEMENT:** The teacher will distribute the handouts of valencies of monovalent, divalent, trivalent ions in the class.

**ASSIGNMENT:** 1. Learn the valencies of the ions given in the handout given to you.

2. Write the molecular formula for the following:
   1. Phosphorous Pentaoxide
   2. Ammonia
   3. Sulphur trioxide
   4. Carbon disulphide
## Hand out: valences of common ion

<table>
<thead>
<tr>
<th>Name</th>
<th>Ion</th>
<th>Symbol</th>
<th>Valency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen</td>
<td></td>
<td>H⁺</td>
<td>1+</td>
</tr>
<tr>
<td>Sodium</td>
<td></td>
<td>Na⁺</td>
<td>1+</td>
</tr>
<tr>
<td>Potassium</td>
<td></td>
<td>K⁺</td>
<td>1+</td>
</tr>
<tr>
<td>Silver</td>
<td></td>
<td>Ag⁺</td>
<td>1+</td>
</tr>
<tr>
<td>Ammonium</td>
<td></td>
<td>NH₄⁺</td>
<td>1+</td>
</tr>
<tr>
<td>Cuprous</td>
<td></td>
<td>Cu⁺</td>
<td>1+</td>
</tr>
<tr>
<td>Divalent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barium</td>
<td></td>
<td>Ba²⁺</td>
<td>2+</td>
</tr>
<tr>
<td>Calcium</td>
<td></td>
<td>Ca²⁺</td>
<td>2+</td>
</tr>
<tr>
<td>Cadmium</td>
<td></td>
<td>Cd²⁺</td>
<td>2+</td>
</tr>
<tr>
<td>Cupric</td>
<td></td>
<td>Cu²⁺ or Cu(II)</td>
<td>2+</td>
</tr>
<tr>
<td>Ferrous</td>
<td></td>
<td>Fe²⁺ or Fe(II)</td>
<td>2+</td>
</tr>
<tr>
<td>Magnesium</td>
<td></td>
<td>Mg²⁺</td>
<td>2+</td>
</tr>
<tr>
<td>Nickel</td>
<td></td>
<td>Ni²⁺</td>
<td>2+</td>
</tr>
<tr>
<td>Zinc</td>
<td></td>
<td>Zn²⁺</td>
<td>2+</td>
</tr>
<tr>
<td>Trivalent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aluminium</td>
<td></td>
<td>Al³⁺</td>
<td>3+</td>
</tr>
<tr>
<td>Chromium</td>
<td></td>
<td>Cr³⁺</td>
<td>3+</td>
</tr>
<tr>
<td>Ferric</td>
<td></td>
<td>Fe³⁺ or Fe(III)</td>
<td>3+</td>
</tr>
<tr>
<td>Auric (gold)</td>
<td></td>
<td>Au³⁺ or Au(III)</td>
<td>3+</td>
</tr>
<tr>
<td>Sulphon</td>
<td></td>
<td>S²⁻</td>
<td>2⁻</td>
</tr>
<tr>
<td>Sulphite</td>
<td></td>
<td>SO³⁻</td>
<td>2⁻</td>
</tr>
<tr>
<td>Borate</td>
<td></td>
<td>B⁰₃⁻</td>
<td>3⁻</td>
</tr>
<tr>
<td>Nitride</td>
<td></td>
<td>N³⁻</td>
<td>3⁻</td>
</tr>
<tr>
<td>Phosphate</td>
<td></td>
<td>PO₄³⁻</td>
<td>3⁻</td>
</tr>
</tbody>
</table>
DAY 3
UNIT 3: Chemical Formula

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Ionic compound
- Naming of ionic compound
- Valency of monovalent, divalent, trivalent cations
- Valency of monovalent, divalent, trivalent anions
- Writing the formula of ionic compound by crossing-over method

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

Q1: Write the valence of the following ions:
   (1) Nitrite  (2) Sulphide  (3) Ferric  (4) Cuprous

Q2: What are the combining capacities of iron and oxygen in Fe₂O₃

Q3: What do you mean by valency?

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD

Ionic compound: Ionic compound are formed by the combination between metals and non-metals.

Naming of Ionic compounds:
1. While writing the formula, the metal is written on the left hand side and non-metal is written on the right hand side.
2. The name of the metal is written as such
3. The name of non-metal is changed to have the ending ‘ide’. For e.g. chloride, oxide, sulphide, etc.

For e.g: 1. MgO is written as magnesium oxide.
Magnesium is metal and is written on left hand side.
Oxygen is a non metal and is written on right hand side. Oxygen is changed to oxide.

2. NaCl is named as Sodium Chloride. Chlorine is a non metal, so it is changed to chloride.

**Writing of formula of ionic compound:**

1. Write the name and symbol of ions.
2. Cations are written on the left hand side and anion on right hand side.
3. Write the valency or charge of the ion below the symbol.
4. Cross over the valency similar to the molecular compound.

**Example of the formula of ionic compounds**

<table>
<thead>
<tr>
<th>Compound</th>
<th>Symbols with valencies</th>
<th>Shifting number of valency</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Magnesium Chloride</td>
<td>Mg^{2+}Cl^-</td>
<td>2</td>
<td>MgCl_2</td>
</tr>
</tbody>
</table>

**GROUP DISCUSSION:** Following Content will be discussed in group discussion using *Think Pair Share Cooperative Strategy*.

Teacher will ask the students to solve the following problems:

(i) Write the names of following compounds: (i) Al_2O_3 (ii) MgCl_2 (iii) Na_2S

(ii) Write the formula of the following compounds:

(I) Sodium carbonate

(II) Calcium oxide

(iii) Nitrogen forms three different compounds with oxygen; N_2O, NO, NO_2

**ASSIGNMENT:** Q1: Write the molecular formula of the following:

1. Copper nitrate
2. Aluminium Chloride
3. Ammonium sulphate
4. Potassium borate

Q2: Write the names of compound represented by the following formula:

1. K_2SO_4
2. CaCO_3
3. KNO_3
4. Al_2(SO_4)_3

**Day 4**

**EVALUATION:** Students will individually appear in formative test 3 for unit 3: Chemical formulae using *STAD (Student Teams-Achievement Divisions) cooperative strategy*.
WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Gram atomic mass
- Molar mass
- Gram molecular mass
- Concept of mole
- Mole of atom and Mole of molecule

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

Q1: Define atomic mass.
Q2: What do you mean by atomic mass unit?

Hybrid Instructional Package: Teaching- Learning Process

Following content will be presented through traditional teaching

GRAM ATOMIC MASS

The amount of a substance, whose mass in grams is numerically equal to its atomic mass, is called gram atomic mass of that substance.

In other words, the atomic mass of a substance expressed in grams is called its gram atomic mass.

For e.g. Atomic mass of oxygen, \( O = 16 \ u \)

So, gram atomic mass of oxygen, \( O = 16 \ g \)

The gram atomic mass of a substance represents the mass of 1 mole (6.022x10^{23} atoms) of atoms of that substance. So, the number of atoms present in 1 gram atomic mass of any substance is 6.022x10^{23} atoms.
MOLAR MASS
The molar mass of a substance is the mass of 1 mole of that substance.

Unit of molar mass: grams per mole (g/mol)

The molar mass of an element is numerically equal to atomic mass expressed in the units of g/mol

For e.g. The atomic mass of hydrogen (H) = 1 u
Gram atomic mass of hydrogen (H) = 1 g
The molar mass of Hydrogen (H) = 1 g/mol

Note: molar mass of an element and gram atomic mass can be used interchangeably.

GRAM MOLECULAR MASS
The amount of a substance, whose mass in grams is numerically equal to its molecular mass, is called gram atomic mass of that substance.

In other words, the molecular mass of a substance expressed in grams is called its gram molecular mass.

For e.g. molecular mass of oxygen, O = 32 u
So, gram molecular mass of oxygen, O = 32 g

The gram molecular mass of a substance represents the mass of 1 mole (6.022x10^23 molecules) of that substance. So, the number of molecules present in 1 gram molecular mass of any substance is 6.022x10^23 molecules.

Numerical: Calculate the molar mass of Ethyne C_2H_2

Solution:
Molar mass of Ethyne = mass of C x 2 + Mass of H x 1
= 12 x 2 + 1 x 2
= 24 + 2 = 26 g/mol

GROUP DISCUSSION:
Teacher will ask the students to solve the following question by using Numbered Head Together cooperative strategy.

✓ Calculate the molar mass of nitric acid, HNO_3

In this strategy:

➤ Each member of a group is given numbers of 1, 2, 3, 4........
➤ Groups work together to solve the question so that all can solve the numerical on the blackboard.
➤ Teacher calls out any number (e.g. three) and each three is asked to give the answer.

MEANING OF MOLE:
Teacher will explain the meaning of mole and then will direct the students to go through the mole concept from CD.
Mole Concept

The mole, as per definition accepted internationally, is defined as, "The mole is the amount of a substance which contains the same number of chemical units (atoms, molecules, or ions) as there are atoms in exactly 12 gram of pure carbon - 12."

OR

"A mole is the quantity of any material which contains one Avogadro’s number (6.023 x 10^23) of chemical units (atoms, molecules, or ions)."

The unit of mole is given by a symbol mol.

1 Mole of atoms = 6.023 x 10^23 atoms
1 Mole of molecules = 6.023 x 10^23 molecules.
1 Mole of ions = 6.023 x 10^23 ions

GROUP DISCUSSION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy

Teacher will ask the students to Synthesize

(I) The relationship between mole of a atom and gram atomic mass
(II) The relationship between mole of a atom and gram molecular mass.

ASSIGNMENT: 1. Write the definition of mole.
2. Calculate molar mass of sulphur molecule, S_8

DAY 6

UNIT 4: Mole Concept

WARM UP: To establish rapport between teacher and student
List of objectives for the topic to help focus the learning:

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. Number of atoms present in one gram atomic mass of a substance ________.
2. Numerical value of Avogadro’s number is ________.
3. What is meant by “a mole of carbon atoms”.

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Hybrid Instructional Package: Teaching-Learning Process

Teacher will solve numerical related to moles of atom through traditional teaching

Point to remember:
1 mole of atoms of an element = gram atomic mass of the element = $6.022 \times 10^{23}$ atoms

Formula used:
Number of moles of atoms = Mass of element in grams/ gram atomic mass of element
Or,
Number of moles of atoms = Mass of element in grams/ molar mass of element

Example 1. Find the number of moles in 0.4 gram of helium (atomic mass of helium = 4)

Solution: We know that
\[
\text{Number of moles} = \frac{\text{Mass of helium in grams}}{\text{Atomic mass}}
\]
\[
= \frac{0.4}{4}
\]
\[
= 0.1 \text{ moles}
\]

Example 2. Calculate the number of moles for $12.044 \times 10^{23}$ number of He atoms

Solution: 1 mole = $6.022 \times 10^{23}$
\[
6.022 \times 10^{23} \text{ number} = 1 \text{ mole of atom}
\]
\[
12.044 \times 10^{23} \text{ number of atoms} = 1 \times 12.044 \times 10^{23}/ 6.022 \times 10^{23}
\]
\[
= 2
\]

Example 3. What is the mass of 4 moles of aluminium atoms (at. Mass of Al = 27u)

Solution: Atomic mass of Al = 27 u
\[
\text{Gram atomic mass of Al} = 27 \text{ g}
\]
1 mole of Al atoms = 27 u
4 mole of Al atoms = 27 X 4 = 108 g

GROUP DISCUSSION: After the content presentation, students will be engaged in group discussion using Three Minute Review cooperative strategy

GROUP DISCUSSION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy

Teacher will ask the students to solve the following numerical:
1. How many moles are 5 grams of calcium.
2. How many moles are $9.033 \times 10^4$.
3. What is the mass of 2 moles of nitrogen atom?
Hybrid Instructional Modules

**ASSIGNMENT**: Solve the following numericals:

1. If 16 g of oxygen contains 1 mole of oxygen atoms, calculate the mass of mass of one atom of oxygen.
2. calculate the number of moles in 100 grams of Iron.

**DAY 7**

**UNIT 4: Mole Concept**

**WARM UP**: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

<table>
<thead>
<tr>
<th>Problem based on mole of molecule</th>
</tr>
</thead>
</table>

**PREVIOUS KNOWLEDGE TESTING**: To stimulate the students of what they already know about the topic

1. What is the relationship between mole of element and gram atomic mass?
2. Complete the following formula: Number of moles of atoms = ____________.

**Hybrid Instructional Package: Teaching-Learning Process**

Teacher will solve numerical related to moles of molecules through traditional teaching

**Point to remember:**

1 mole of molecules of an element = gram molecular mass of the element = $6.022 \times 10^{23}$ molecules

**Formula used:**

Number of moles of molecules = Mass of substance in grams/ gram molecular mass of element

Or, Number of moles of molecules = Mass of substance in grams/ molar mass of element

**Example 1**: Calculate the mass of 0.5 mole of water (H₂O)

**Solution**: 1 mole of H₂O = molecular mass of H₂O in grams

= mass of 2H atoms + mass of O atom

= $2 \times 1 + 16 = 18$ g

Mass of 1 mole of H₂O = 18 g

Mass of 0.5 mole of H₂O = 0.5 x 18g = 9 g
Example 2: Calculate the number of particles in 8 g of O₂ mol.

**Solution:**
1 mole of O₂ molecule = 32 g = \(6.022 \times 10^{23}\)
8 g of O₂ contains \(6.022 \times 10^{23} \times 8/32 = 1.51 \times 10^{23}\) particles.

Example 3: Calculate the number of ions present in 0.051 g of aluminium oxide.

**Solution:**
Mass of aluminium ion = mass of aluminium atom
1 mole of Al₂O₃ = 2 x Al + 3 x O = 102 g
Mass of Al in 1 mole of Al₂O₃ = mass of Al x 2 = 27 x 2 = 54 g
102 g of Al₂O₃ contains 54 g of Al
0.051 g of Al₂O₃ = 54 x 0.051/102 = 0.027 g of Al
Now, 27 g of Al ion contains \(6.023 \times 10^{23}\) ions
0.027 g of Al ion = \(6.023 \times 10^{23} \times 0.027/27 = 6.022 \times 10^{20}\) ions

**GROUP DISCUSSION:** After the content presentation, students will be engaged in group discussion using Three Minute Review cooperative strategy.

Teacher will ask the students to solve the following two questions by using Numbered Head Together cooperative strategy:
- Calculate the number of molecules in 0.25 moles of oxygen.
- Calculate the mass of 5 moles of sodium carbonate.

**ASSIGNMENT:** Solve the following numericals:

1. Calculate the number of magnesium ions present in 0.050 g of magnesium chloride.

**DAY 8**

**EVALUATION:** Students will individually appear in formative test 4 for unit 4: Mole Concept using STAD (Student Teams-Achievement Divisions) cooperative strategy.

**DAY 9**

Teacher will take posttest of Summative Test II.
Appendix A-1 (iii)

MODULE 3

STRUCTURE OF THE ATOM

Content Sequence:

Unit V: Model of atom-I
- Subatomic particles in Matter; Electron, Proton and Neutron
- Thomson Model of Atom
- Rutherford’s Model of Atom

Unit VI: Model of atom-II
- Bohr’s Model of Atom
- Atomic Number
- Mass Number
- Problems based on Atomic Number and Mass Number

Enduring understanding

Atoms and molecule are the building blocks of matter. The existence of different kinds of matter around us is due to the different types of atoms and molecules present in them. Dalton’s atomic theory suggested atom was indivisible, so they do not have an inner structure. But the discovery of subatomic particles- electrons and protons inside the atom, led to the failure of Dalton’s atomic theory. It was then considered necessary to know how these subatomic particles are arranged with in the atom. For explaining this, many scientists proposed various atomic models. These models led to the conclusion that protons are present in the nucleus and the electrons revolve round the nucleus in circular paths called orbits. The number of protons present in an atom determines its atomic number. After the discovery of proton and neutron, it was noticed that all the mass of atom cannot be accounted for on the basis of only proton and electron present in it. This problem was solved by the discovery of another subatomic particle called neutron in the nucleus in the year 1932. Since the mass of electron is negligible, the real mass of proton and neutron present in one atom of an element is known as its mass number.

Behavioural Objectives of the Module: Listed in Table 3.2 in Chapter 3

DAY 1

Teacher will hold pretest of summative test III followed by brief introduction of the module 3.
DAY 2

UNIT 5: Model of atom-I

WARM UP: To establish rapport between teacher and student
List of objectives for the topic to help focus the learning:

- Discovery of electron
- Discovery of proton
- Discovery of neutron
- Thomson’s model of the atom

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. Name the subatomic particles present in the nucleus of atom.
2. Name the negatively charged sub atomic particle of atom.
3. What is the mass of electron?
4. What is the charge of a neutron?
5. Why is atom electrically neutral?

Hybrid Instructional Package: Teaching- Learning Process

Following content will be presented through CD:

Atom is made up of three subatomic particles: electrons, protons and neutrons.

DISCOVERY OF PROTON:

E. Goldstein in 1886 discovered the presence of a new radiation in a gas discharge tube. He called them canal rays. Canal rays were positively charged. This led to the discovery of proton. He found that charge to mass (e/m) ratio of the positive ray particles depends on the nature of gas in the discharge tube. The e/m value for positive rays was highest when hydrogen gas was used in the discharge tube. The particle in the positive rays when hydrogen gas was used in the discharge tube, was given the name proton.

\[ H \rightarrow H^+ + e^- \]

Hydrogen atom Proton electron
Thus, proton is a hydrogen ion \((H^+)\)

**DISCOVERY OF ELECTRON:**

In 1897, an English physicist, **J. J. Thomson**, studied the effect of an electric field on cathode rays. He used a discharge tube which had the following parts.

- A Cathode (C)
- Anode (A), which is a cylindrical metal disc with a hole at its centre.
- Fluorescent screen E
- Plates \(P_1\) and \(P_2\) connected to a source of high voltage.
- Electromagnet

![Diagram of J.J. Thomson's experiment](image)

**J.J. Thomson’s experiment:**

combined effect of electric and magnetic fields on cathode rays

In the absence of any electrical and magnetic field, the cathode rays strike the fluorescent screen at point E and can be seen as a bright spot there. When a high electric field is applied across the plates \(P_1\) and \(P_2\), the spot on the screen moves towards the positively charged plate (\(P_2\)). The bending of cathode rays towards the positive plate proves that the cathode rays are made up of negatively charged particles.

**DISCOVERY OF NEUTRON**

Till 1920, an atom was considered to be consisting of only electrons and protons. Electrons have negligible mass. So, the whole mass of an atom was considered to be only due to protons in it. But this was not the case always. For e.g. in case of helium, there are two protons in its nucleus and hence its atomic mass should be \(2 \times 1.008 = 2.06\) amu. However, experimental value of atomic mass of helium is 4.003 amu. This difference in mass could be explained by assuming that there are other particles present within the nucleus which have the same mass as proton, but are electrically neutral. Later in 1932, Chadwick discovered the presence of neutral particles inside the atoms. Since, these particles are neutral, hence these were named neutrons.
**THOMSON ATOMIC MODEL**

J.J. Thomson proposed a model to explain the arrangement of electrons, protons and neutrons within an atom around the nucleus. This model is known as **Plum pudding model** of the atom.

According to this model,

- An atom is considered to be a sphere of uniform positive charge, and electrons are embedded into it. They resemble raisins in a plum pudding.
- Total positive charge in an atom is equal to total negative charge due to electrons.
- There is uniform distribution of the mass of the atom.

**Limitation**

This model was unable to explain how positively charged particles were shielded from negatively charged particles, without getting neutralized.

**GROUP DISCUSSION:** After the content presentation, students will be engaged in group discussion using Three Minute Review cooperative strategy

**ASSIGNMENT:** Compare the properties of electron, proton and neutron.

**DAY 3**

UNIT 5: Model of atom-I

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Rutherford's scattering experiment
- Rutherford's model of atom
- Drawback of Rutherford's
Hybrid Instructional Modules

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. Which subatomic particle was not present in Thomson’s model of the atom?
2. Name the particles used by Rutherford in his scattering experiment.
3. Which part of an atom was discovered by Rutherford’s alpha scattering experiment?
4. What are alpha particles?

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD:

DISCOVERY OF NUCLEUS

Rutherford’s scattering Experiment:

The alpha (α) scattering experiment was performed by Rutherford to test the J.J. Thomson’s atomic model. In his experiment, Rutherford bombarded a thin sheet of gold foil (0.00006 cm thick) with alpha particles in an evacuated chamber.

- Most of the α particles passed through the foil straight.
- Some of the α particles were deflected through small angles and a few through larger angles.
- One particle out of every 10,000 returned back i.e rebound back.

GROUP DISCUSSION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy

Teacher will ask the students to discuss this question What conclusions can you draw out from the observations of Rutherford’s alpha scattering experiment?
Following content will be presented through CD:

RUTHERFORD’S MODEL OF THE ATOM:
Main postulates of the model are:

- An atom consists of positively charged nucleus, which is surrounded by electrons that move around it.
- Electrons and the nucleus are held together by coulombic forces of attraction.
- The entire mass of an atom is concentrated in its nucleus.
- The size of the nucleus is very small compared to size of the atom.
- The number of protons inside the nucleus of an atom is equal to the number of electrons surrounding the nucleus. Therefore, atom as a whole is electrically neutral.

Drawbacks

Despite being simple, the Rutherford’s nuclear model has certain limitations.

(i) According to the classical electrodynamics, if an electrically charged particle revolves around a circular path, it must always continuously emit radiation and lose energy. Thus, the electrons in an atom must also lose energy and emit radiation. Due to loss of energy, the electron would slow down and it would also not be able to resist the attraction of the nucleus. As a result, the electron would follow a spiral path and ultimately fall into the nucleus. But such a case does not happen and atoms are stable. Thus Rutherford’s model could not explain the stability of atom.

(ii) Also the arrangement of electrons in an atom could not be explained by Rutherford’s nuclear model.

GROUP DISCUSSION: After the content presentation, students will be engaged in group discussion using Three Minute Review cooperative strategy

ASSIGNMENT: What important informations are furnished about the nucleus of an atom by the alpha particles scattering experiment of Rutherford.
DAY 4

EVALUATION: Students will individually appear in formative test 5 for unit 5: Model of atom-I using STAD (Student Teams-Achievement Divisions) cooperative strategy.

DAY 5

UNIT 6: Model of atom-II

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Bohr's model of atom
- Stability of atom as explained by Bohr
- Atomic number

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

Que: State whether the following statements are True or false

1. Almost all the mass of an atom is concentrated in nucleus.
2. Number of protons present in an atom determines its atomic number.
3. Atomic number is equal to the number of electrons present in the nucleus.

Hybrid Instructional Package: Teaching- Learning Process

Following content will be presented through CD:

BOHR'S MODEL OF THE ATOM:

In order to explain the stability of an atom, Neils Bohr, a Danish physicist gave a new arrangement of electrons in the atoms in 1913. According to Neils Bohr, electrons revolve around the nucleus in only certain orbits and each orbit has a different radius. The electrons near nucleus have low energy and electrons farther away from the nucleus have higher energy. According to Neil Bohr, when electrons revolve in a particular energy level around the nucleus, electrons do not radiate energy, even though they have accelerated motion around the nucleus.

Since electrons do not lose energy while revolving in certain orbits, so electron do not fall into the nucleus, and hence the atoms remain stable.
Hybrid Instructional Modules

The electrons revolve around the nucleus in fixed circular paths called energy levels or shells. The energy level can be represented by the number 1, 2, 3, 4, 5 and 6 or by the letters K, L, M, N, O and P. The counting of energy levels are from the centre.

GROUP DISCUSSION: After the content presentation, students will be engaged in group discussion using Three Minute Review cooperative strategy.

GROUP DISCUSSION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy.

Explain the stability of an atom in accordance to Bohr’s model of an atom

Following content will be presented through CD:

Atomic Number:

The number of protons present in the nucleus of an atom is called its atomic number and is denoted by “Z”. Atomic number of an element is also equal to the number of electrons present in the shells around the nucleus, since atom as whole is electrically neutral. So,

\[
\text{Atomic number} = \text{Number of protons in the nucleus} = \text{Number of electrons in the nucleus}
\]

Two different elements can never have the same atomic number.

The subscript on the atomic symbol denotes the atomic number. For e.g. In symbol _{12}X, 12 denotes the atomic number.

ASSIGNMENT: Compare all the three models of atom- Thomson’s model of atom, Rutherford’s model of atom and Bohr’s model of atom.
DAY 6
UNIT 6: Model of atom-II

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Atomic Number
- Mass Number
- Calculation of Electron, Protons and Neutrons

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

Que: State whether following statements are True or false

1. Atomic number is written as subscript in the symbol of element
2. Define atomic number.
3. What do you mean by mass number?

Hybrid Instructional Package: Teaching-Learning Process

GROUP DISCUSSION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy

Teacher will ask the students to give reason for the following statements:

1. Two different elements cannot have same atomic number.
2. Atomic number of element is equal to the number of electrons in a neutral atom, and not in ion.
3. The atomic number of an element does not change during chemical reaction.

Following content will be presented through CD:

Atomic mass/ Mass number

According to Rutherford's model, whole of the mass of an atom is situated at the centre of the atom, i.e., in the nucleus of the atom. So the sum of protons and neutrons present in the nucleus is called atomic mass. The atomic mass is denoted by the symbol 'A'.

Atomic mass (A) = Number of protons + Number of neutrons

= Atomic number of the elements + Number of neutrons.
The superscript on the atomic symbol denotes the atomic mass. For e.g. In symbol $^{12}_X$, 12 denotes the atomic mass.

**Calculation of electrons, protons and neutrons**

Atom of an element is represented by a symbol. Atomic number is represented by 'Z' and written as subscript on the left side of the symbol. Atomic weight is represented by 'A' written as superscript made in right side.

Let the symbol of element be $X$ then it is represented with atomic number (Z) and atomic mass (A) as $^{A}_Z X$.

Let us consider an example of chlorine atom. It's atomic number is 17 and atomic weight is 35. So we will represent it as $^{35}_{17}Cl$.

So, Number of electrons in chlorine atom = 17
Number of Protons in chlorine atom = 17
Number of neutrons in chlorine atom

\[ \text{Number of neutrons} = \text{Atomic weight} - \text{Atomic number} \]
\[ = A - Z \]
\[ = 35 - 17 \]
\[ = 18 \]

**GROUP DISCUSSION:** Teacher will ask the students to solve the following questions by using Numbered Head together cooperative strategy.

- Why the mass of electron is not taken into consideration while calculating the mass number of an element.
- Calculate the atomic number of an element having mass number 23 and neutron 12.
- If an element has atomic number 15 and mass number 31, how many neutrons does its atom contain?

**ASSIGNMENT:** Helium atom has an atomic mass of 4u and two protons in its nucleus. How many neutrons does it have?

**DAY 7**

**EVALUATION:** Students will individually appear in formative test 6 for unit 6: Model of atom-II using STAD (Student Teams-Achievement Divisions) cooperative strategy

**DAY 8**

Teacher will take posttest of summative test III
Content Sequence:

Unit 7: Arrangement of electrons in the atoms
- Electronic Configuration of Element
- Atomic Structure of Element
- Valence Electron
- Inertness of Noble Gases
- Causes of Chemical Combination
- Valency of Metals and Non-Metals

Unit 8: Isotopes and Isobars
- Concept of Isotope
- Properties of Isotopes
- Fractional Atomic Mass of Element and Numericals
- Radioactive Isotopes and their Applications
- Concept of Isobar

Enduring understanding

Bohr’s model suggested that the electrons revolve rapidly round the nucleus in fixed concentric paths called orbits or energy shells, numbered as K, L, M, N... The distribution of electrons into different orbits is governed by rules, suggested by Bohr and Bury. The outermost shell of an atom can accommodate maximum of eight electrons. The atoms of the element, having completely filled outermost shell is most stable. The electrons present in outermost shell of an atom are known as valence electrons. They decide the combining capacity of the atom as the atom share, gain or lose the electron to achieve the octet.

In nature, most of the elements have number of atoms which have the ‘same atomic number’ but different mass number. Such atoms of element are called Isotopes. In some cases, the atoms of different elements having different atomic number may have the same mass number. Such atoms are called Isobars.

Behavioural Objectives of the module: List in Table 3.2 in Chapter 3

DAY I

Teacher will hold pretest of Summative Test IV followed by brief introduction of the module IV.

xxxvi
DAY 2

UNIT 7: ARRANGEMENT OF ELECTRONS IN THE ATOMS

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Arrangement of electrons in the atom - Bohr and Bury rule
- Electronic configuration
- Atomic structure of an element

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. What are the various letters used by Bohr to represent electron shells in an atom?

2. Fill in the blanks:
   - (a) The shell nearest to nucleus will have _______ energy
   - (b) Energy is _______ when electron jumps from inner orbit to an outer orbit.
   - (c) Electron moves in its orbit _______ loss of energy.

Hybrid Instructional Package: Teaching - Learning Process

Following content will be presented through CD:

Electronic configuration:

The arrangement of electrons in the various shells of an atom of the element is known as electronic configuration.

The maximum number of electrons which can be put in a particular shell was given Bohr and Bury.

According to this rule:

(i) The maximum number of electrons present in any shell of an atom is given by the formula $2n^2$, where $n$ is the number of shell as counted from the nucleus.

<table>
<thead>
<tr>
<th>Shell Number</th>
<th>Maximum number of electrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>K or 1</td>
<td>$2n^2 = 2 (1)^2 = 2$</td>
</tr>
<tr>
<td>L or 2</td>
<td>$2n^2 = 2 (2)^2 = 8$</td>
</tr>
<tr>
<td>M or 3</td>
<td>$2n^2 = 2 (3)^2 = 18$</td>
</tr>
<tr>
<td>N or 4</td>
<td>$2n^2 = 2 (4)^2 = 32$</td>
</tr>
</tbody>
</table>
Stability of an atom depends upon the number of electrons present in the outermost shell. An atom becomes stable when its outermost shell has eight electrons or it has only one shell containing 2 electrons.

(iii) new shell is formed as the outermost shell attains 8 electrons

(iv) The outermost shell cannot have more than 8 electrons and last but one shell i.e. penultimate shell cannot have more than 18 electrons.

**GROUP DISCUSSION:** After the content presentation, students will be engaged in group discussion using *Three Minute Review* cooperative strategy.

**Following content will be presented through traditional teaching:**

Teacher will explain the students the method of writing electronic configuration by following example.

**Example 1:** Write the electronic configuration of an element X whose atomic number is 12.

**Solution:** Atomic number is 12

(i) Firstly, electrons will go to K shell which can accommodate maximum of two electrons. i.e. K=2

(ii) After filling K, electrons will go to L, which can maximum of 8 i.e. L=8

(iii) Now we are left with 2 (2 +8=10) electrons and they will go to M i.e. M=2

So, electronic configuration will be 2, 8, 2...

Similarly, the electronic configuration can be worked for any element

**Atomic Structure of an element:**

The atomic number and mass number of an element enable us to draw the atomic structure of an element.

(i) Firstly find the number of electrons, protons and neutrons.

(ii) Place protons and neutrons in the nucleus. Electrons are represented as dots on the circle, as per Bohr-Bury Scheme.
Example:

<table>
<thead>
<tr>
<th>Element</th>
<th>Symbol with Atomic no. &amp; Atomic weight</th>
<th>No. of electrons</th>
<th>No. of protons Z</th>
<th>No. of neutrons (A-Z)</th>
<th>Electron configuration K, L, M, N</th>
<th>Geometric representation of Atomic structure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boron</td>
<td>$^5\text{B}^{11}$</td>
<td>5</td>
<td>5</td>
<td>11-5=6</td>
<td>2, 3...</td>
<td><img src="image" alt="Boron Geometric Representation" /></td>
</tr>
<tr>
<td>Carbon</td>
<td>$^6\text{C}^{12}$</td>
<td>6</td>
<td>6</td>
<td>12-6=6</td>
<td>2, 4...</td>
<td><img src="image" alt="Carbon Geometric Representation" /></td>
</tr>
</tbody>
</table>

**GROUP DISCUSSION:** teacher will engage the students in group discussion using **Round Table** or **Rally Table** Cooperative Strategy

Teacher will ask the students to solve the following –

1. *If both K and L shell of an atom are full, what will be the atomic number of atom*

2. *Write the electronic configuration of atom with atomic number-10, 8, 14.*

3. *Write the Draw atomic diagram of element having atomic number 9.*

**ASSIGNMENT:** The maximum number of electrons in the outermost shell is 8, even if it can accommodate more electrons. Explain by giving example.
WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Concept of valence electrons
- Inertness of noble gases
- Cause of chemical combination
- Valency of metal and non-metal

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. What do you mean by valency?
2. What is the valency of (i) carbon (ii) Nitrogen (iii) oxygen

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented traditional teaching:

Valence electrons:

The electrons present in the outermost shell of an atom are known as valence electron because they decide the combining capacity of the atom.

The outermost shell of an atom is known as valence shell. Only the valency electrons of an element take part in chemical reactions because they have more energy than all the inner electrons of the atom.

For e.g. Sodium has atomic number = 11

Electronic configuration of sodium = 2, 8, 1

Here M is the valence shell or outermost shell. It has 1 electron. Therefore sodium has 1 valency electron. When it combines with other atoms, only one electron of M shell takes part in chemical combination.

Valence electrons are also defined as those atoms which take part in chemical reactions.
Cause of chemical combination:

Each electron of an element is chemically reactive (except noble gases) and reactivity depends upon the number of electrons present in the outermost shell. Each atom attains stability by completing its outermost shell with electrons (according to octet rule). An atom can complete its outermost shell by losing electrons, by accepting electrons and by sharing electron. So, “valency of an atom is the number lost or gained or shared by an atom of an element so as to have stable electronic configuration of the nearest noble gas.”

An atom can achieve the inert gas electron arrangement in three ways:
(i) Donating one or more electrons from their valence shell to another atom.
(ii) Gaining one or more electrons in their valence shell from another atom.
(iii) By sharing one or more electrons from their valence shell with another atom.

Valency of element:

The capacity of an element to form the chemical bonds is known as its valency. The valency of an element is decided by the number of valence electrons in its atom.

Valency of metal: Valency of metal is equal to valence electrons in its atom. E.g. Sodium has 1 valence electron and the valency of sodium is 1.

Valence of non metal: It is equal to 8 minus the number of valence electron in atom. E.g. Chlorine has 7 valence electrons but its valency is not 7. It only requires one electron to complete its octet. Therefore its valence is 1 (i.e. 8 – 7 =1)

Carbon (C=2,4) and Silicon (Si=2,8,4) have four electrons in their valence shells. Therefore, their valency is 4.

Nitrogen (N=2,5) and phosphorus (P=2,8,5) have 5 electrons in the outermost shell. Therefore it is easy to accept 3 electrons from another atom. Therefore, their valency is 3.

Oxygen (O=2,6) and sulphur (S=2,8,6) have 6 electrons in the outermost shell. Therefore it is easy to accept 2 electrons from another atom. So, their valency is 2.

Fluorine (F=2,7) and chlorine (2,8,7) have 7 electrons in the outermost shell. Therefore it is easy to accept an electron from another atom. So, their valency is 1.

GROUP DISCUSSION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy. Teacher will ask the students to:

1. “Explain by giving example why, noble gases are chemically inert”.

2. “What is the relation between valency of an element and the number of valence electrons in its atom? Explain with example.”

3. What will be the valency of element with atomic number 16?
**ASSIGNMENT**: Complete the following table:

<table>
<thead>
<tr>
<th>Number of protons</th>
<th>Number of electrons</th>
<th>Mass number</th>
<th>Atomic number</th>
<th>Number of electrons</th>
<th>valency</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DAY 4**

**EVALUATION**: Students will individually appear in formative test 7 for unit 7: Arrangement of electrons in the atoms using **STAD (Student Teams-Achievement Divisions)** Cooperative Strategy

**DAY 5**

**UNIT 8: ISOTOPES AND ISOBARS**

**WARM UP**: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Concept of Isotope
- Properties of Isotope
- Fractional Atomic Mass of Elements

**PREVIOUS KNOWLEDGE TESTING**: To stimulate the students of what they already know about the topic

Q 1: What do you mean by isotope?
Q 2: Give one example of isotope.
Q 3: Name the three isotopes of hydrogen.

**Hybrid Instructional Package: Teaching-Learning Process**

Following content will be presented through CD:

**Isotopes**

According to **John Dalton's atomic theory**, all atoms of an element are of same type. But discovery of **isotopes** by Soddy proved that the atoms of an element can be of different type.

So, "Atoms of the same element, having the same atomic number but different mass numbers are called isotopes."

For example (i) Hydrogen has three isotopes. They are:

(i) **Protium** (\(^{1}H\))
(ii) **Deuterium** (\(^{2}H\))
(iii) **Tritium** (\(^{3}H\))
(ii) Oxygen has two isotopes. They are: $\overset{16}{8}O$, $\overset{17}{8}O$

(iii) Chlorine has two isotopes: $\overset{35}{17}Cl$, $\overset{37}{17}Cl$

Properties of isotopes:

1. The number of protons in all isotopes of an element is same. Thus, chemical properties of all isotopes are identical.
2. The physical properties, such as mass, density, melting point etc. of isotopes of the same element are different.
3. All isotopes of the same element have same valency.
4. The number of valence electrons of all isotopes of same element is similar.

**GROUP DISCUSSION:** After the content presentation, students will be engaged in group discussion using *Three Minute Review* Cooperative Strategy
Fractional atomic masses of element:
The atomic mass of an element is a whole number, but the relative atomic mass or atomic weight of an element is not necessarily a whole number. This is because the atomic mass of an element is the average relative mass of all the natural isotopes of that element.

Example: Chlorine has two isotopes having mass 35 and 37. The two isotopes occur in the approximate ratio of 3:1. Therefore the relative atomic mass is 35.5u.

Atomic weight= \( \frac{3 \times 35 + 1 \times 37}{4} = \frac{142}{4} = 35.5 \)

**GROUP DISCUSSION:** Teacher will ask the students to solve the following questions by using Numbered Head Together Cooperative Strategy.

1. Isotopes have different physical properties but similar chemical properties. Explain.
2. Given the percentage abundance of the isotope \(^{10}\text{Ne}^{20}\) is 90% and that of the isotope \(^{10}\text{Ne}^{22}\) is 10%, calculate the average atomic mass of neon.

**ASSIGNMENT:** Which of the following pairs are isotopes? Give reasons for your choice.

(i) \(^{26}\text{A}^{16}, \; ^{28}\text{B}^{18}\)  
(ii) \(^{35}\text{X}^{79}, \; ^{35}\text{Y}^{80}\)

**DAY 6**

**UNIT 8: ISOTOPES AND ISOBARS**

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Radioactive isotope
- Application of Isotopes
- Concept of Isobar

**PREVIOUS KNOWLEDGE TESTING:** To stimulate the students of what they already know about the topic

Q 1: State whether the following statements true or false.
1. Isotopes have different chemical properties
2. Isotopes occupy same position in periodic table
3. Isotopes have different mass number because their nuclei contain different number of protons.
Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through traditional teaching:

Radioactive isotope:

The isotope which are unstable (due to the presence of extra neutrons in their nuclei) and emit various types of radiations, are called radioactive isotopes (or just radioisotope).

Example: Carbon-14, Arsenic-74, Sodium-24, Iodine-131, cobalt-60 and Uranium-235.

Applications of isotope:

1. Uranium-235 isotope is used as a fuel in the reactors of nuclear power plants for generating electricity.
2. They are used as tracers in medicine to detect the presence of tumors and blood clots, etc. in human body. Arsenic-74 is used to detect the presence of tumors and sodium-24 is used to detect blood clots.
3. Iodine-131 is used to determine the activity of thyroid glands which helps in the treatment of diseases like goiter.
4. Cobalt-60 is used in the treatment of cancer.
5. These are used in industry to detect the leakage in underground oil pipelines, gas pipelines and water-pipes.

Isobars:

These are the atoms of different elements having different atomic number same mass number or atomic masses. They have different number of protons in their nuclei but the total number of nucleus (proton + neutron) in them is same.

Examples:

(i) $^3{}\text{H}$ and $^3{}\text{He}$ have same atomic mass of 3 but different atomic numbers.
(ii) $^{36}\text{Ar}$, $^{39}\text{K}$ and $^{40}\text{Ca}$ have same atomic mass of 40 but different atomic numbers.
(iii) $^{130}\text{Te}$, $^{130}\text{Ba}$ and $^{130}\text{Xe}$ have same atomic mass of 130 but different atomic numbers.

Differences between isotopes and isobars

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Isotopes</th>
<th>S.N.</th>
<th>Isobars</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>They are the atoms of the same element with same atomic number.</td>
<td>1</td>
<td>They are the atoms of different elements with same atomic mass.</td>
</tr>
<tr>
<td>2</td>
<td>They have same chemical properties.</td>
<td>2</td>
<td>They have different chemical properties.</td>
</tr>
<tr>
<td>3</td>
<td>They cannot be separated by chemical means.</td>
<td>3</td>
<td>They can be easily separated by chemical means.</td>
</tr>
</tbody>
</table>
**Hybrid Instructional Modules**

**Numerical:** A sample of an element X contains two isotopes $^8\text{X}^{16}$ and $^8\text{X}^{18}$. If the average atomic mass of this sample of the element be 16.4, calculate the percentage of two isotopes in this sample.

**Solution:** Let the % of one of isotope $^8\text{X}^{16}$ is $x\%$

- % of other isotope, $^8\text{X}^{18}$ be $(100-x)\%$
- Average atomic mass of $x = 16 \times x/100 + 18 \times (100-x)/100$
- $16.2 = 16x + 1800 - 18x/100$
  
  
  $2x = 180$

  
  $x = 180/2 = 90$

- % of $^8\text{X}^{16}$ in the sample is 90%
- % of $^8\text{X}^{18}$ in the sample is $(100-90) = 10\%$

**GROUP DISCUSSION:** Following Content will be discussed in group discussion using *Think Pair Share* Cooperative Strategy. Teacher will ask the students to solve the following:

1. Which two of the following atomic species are isotopes of each other and which two are isobars?

   $^{231}\text{Zr}$, $^{230}\text{Zr}$, $^{230}\text{Y}$, $^{233}\text{Y}$

2. An element X contains two isotopes $\text{X}^{16}$ and $\text{X}^{18}$. If the average atomic mass of this sample of the element be 35.5u, calculate the percentage of two isotopes in this sample.

**ASSIGNMENT:** Write the electronic configuration of any one pair of (a) isotope and (b) isobars.

**DAY 7**

**EVALUATION:** Students will individually appear in formative test 8 for unit 8: Isotopes and Isobars using *STAD (Student Teams-Achievement Divisions)* Cooperative Strategy

**DAY 8**

Teacher will take posttest of Summative Test IV
Appendix A-3 (v)

MODULE 5 (BIOLOGY)

FUNDAMENTAL UNIT OF LIFE

Content Sequence:

Unit 9: Cell
- Important discoveries related to Cell
- Unicellular and Multicellular Organism
- Prokaryotic and Eukaryotic Cells
- Structure of Cell
- Plasma Membrane: Structure and Function
- Diffusion and Osmosis
- Isotonic, Hypertonic and Hypotonic solution
- Cell Wall: Structure and Function
- Nucleus: Structure and Function

Unit 10: Cell organelles
- Cytoplasm
- Mitochondria: Structure and Function
- Endoplasmic Reticulum: Structure and Function
- Golgi Apparatus: Structure and Function
- Lysosomes: Structure and Function
- Vacuoles: Structure and Function
- Plastids: Structure and Function

Enduring Understanding

Cell is the basic structural and functional unit of life as it performs different vital functions with the help of different organelles. Different organelles like mitochondria, endoplasmic reticulum Golgi apparatus, lysosomes, vacuoles and plastids have different function in the cell. All the cells are found to have same organelles, no matter what their function is or what organism they are found in.

Behavioural Objectives of the module: Listed in Table 3.2 of Chapter 3

DAY 1

Teacher will hold pretest of Summative Test V followed by brief introduction of the Module V
DAY 2
UNIT 9: CELL

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Prokaryotic and Eukaryotic cell
- Structure of Plasma membrane
- Diffusion and osmosis
- Endocytosis

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. What are unicellular organisms?
2. Name two unicellular organisms.
3. What are multicellular organisms?
4. Name two multicellular organisms.

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD:

Discovery of the cell

Antony Van Leeuwenhoek (1632 - 1723), a Dutch microscopist was the first to observe and describe, minute microscopic organisms in rain water. He used simple microscope to observe cells. The term 'cell' is derived from the Latin word 'cellula' which means "a little room" was given by an English scientist Robert Hooke. He examined a thin slice of bottle cork under a microscope and observed honeycomb like structures that resembled cells.

Main Points:

1. Cells were first discovered by Robert Hooke in 1665
2. Robert Brown in 1831 discovered nucleus in the cell
3. Purkinje in 1839 coined the term Protoplasm
4. Cell Theory was given by Schleiden and Schwann
Cell Shape: The shape and size of cells are related to the function they perform

<table>
<thead>
<tr>
<th>Organism</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoeba, Mycoplasma.</td>
<td>Variable</td>
</tr>
<tr>
<td>Squamous epithelium, epidermis.</td>
<td>Flattened</td>
</tr>
<tr>
<td>Nerve cells, trachieds (plants)</td>
<td>Elongated</td>
</tr>
<tr>
<td>Bacteria (bacillus species)</td>
<td>Rod shaped</td>
</tr>
<tr>
<td>Phloem vessels (plants)</td>
<td>Tubular</td>
</tr>
</tbody>
</table>

Cell size

Cell are extremely small and can only be seen under the microscope. The size of cell are measured in micrometres ($\mu$m); micrometres are sometimes called micron ($\mu$).

Longest Cell: Nerve cells in animals
Smallest cell: Mycoplasm (bacteria)

Prokaryotic cells and Eukaryotic cells:

<table>
<thead>
<tr>
<th>Prokaryotic cell</th>
<th>Eukaryotic cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size of cell is generally small (1-10$\mu$m)</td>
<td>Size of cell is generally large (5-100 mm)</td>
</tr>
<tr>
<td>Nucleus is absent</td>
<td>Nucleus is present</td>
</tr>
<tr>
<td>Nuclear region is surrounded by a nuclear membrane</td>
<td>Nuclear material is surrounded by nuclear membrane</td>
</tr>
<tr>
<td>Nucleolus is absent</td>
<td>Nucleus is present</td>
</tr>
<tr>
<td>Membrane bound cell organelles are absent.</td>
<td>Membrane bound organelles like mitochondria, Golgibodies, endoplasmic reticulum, lysosomes, peroxisomes, are present</td>
</tr>
<tr>
<td>Cell division takes place by fission or budding (no mitosis)</td>
<td>Cell division occurs by mitotic or meiotic cell division.</td>
</tr>
</tbody>
</table>

GROUP DISSCUTION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy:

Why cell is called structural and functional unit of Life?
Structure of Cell:

Plasma membrane of cell membrane

(i) Cell membrane is the outer covering of cell. It separates the contents of the cell from its external environment.

(ii) It is found in both plants and animals.

(iii) It is selectively permeable i.e. it permits the entry and exit of some materials in and out of the cell.

(iv) The plasma membrane is made up of proteins and lipids. Generally lipids form a bilayer in which proteins are embedded. The lipid molecules have a polar end (head) and non-polar end (tail) which face each other.

**Diffusion:** The movement of substances from a region of higher concentration to region of lower concentration.

**Osmosis:** The movement of water from a region of higher concentration to region of lower concentration when separated through a semi-permeable membrane.

**GROUP DISCUSSION:** Following content will be discussed in group discussion using *Think Pair Share* cooperative strategy:

Que 1: Why is plasma membrane called selectively permeable membrane?

Que 2: What happens when dried raisins are put in pure water and concentrated sugar solution?

Que 3: How do substances like CO₂ and O₂ move in and out of the cell?
DAY 3
UNIT 9: CELL

WARM UP: To establish rapport between teacher and student
List of objectives for the topic to help focus the learning:

- Structure of Cell wall
- Structure of Nucleus

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

Que 1: Differentiate between diffusion and osmosis;
Que 2: What are the main functions of plasma membrane?
Que 3: What is the main difference between plant cell and animal cell?

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD:

Structure of Cell wall:

Cell wall

Cell wall is the non living, rigid covering surrounding all plant cells. It is composed mainly of cellulose. Cellulose is a made of a chain of glucose molecules joined by 1-4 glycosidic bonds. It is permeable to water, solutes and gases.

Animal cells lack cell wall.

Cell wall of fungi is made up of 'Chitin'.
Structure of Nucleus:

**Nucleus**

**Discovery**: Robert Brown in 1931 described nucleus for the first time as a dark stained body present in all the cells.

**Occurrence**: Nucleus is found in all eukaryotic cells but is absent in prokaryotes, i.e. bacteria, viruses and mycoplasmas.

Some cells like sieve tubes of vascular plants and the red blood cells of mammals lack nuclei at maturity (they have nuclei in their early stages).

**Number**: Generally, there is a single nucleus per cell but **binucleate and multinucleate** conditions are also found.

**Shape**: It is a highly variable feature and may keep changing even for the same cell during different developmental stages. Few common shapes are oval, discoid, kidney shaped, spherical etc. Few common shapes with examples are given below:

Nucleus has following components:

(i) **Nuclear membrane**: Nuclear membrane separates the nucleus from the cytoplasm. It is a double layered membrane. The two membranes are separated by **per nuclear space** (usually 200 Å). The membrane is perforated by several **nuclear pores**, which allow the exchange of materials between the nucleus and cytoplasm.

(ii) **Nucleoplasm**: It is the cytoplasm within nuclear membrane is which nucleoli and chromatin are suspended.

(iii) **Nucleolus**: It is a spherical body present in the nucleus. Nucleolus lacks a membrane. It is rich in **RNA** (ribonucleic acid); is concerned with the formation of ribosomes, and helps in protein synthesis.

(iv) **Chromatin material**: A nucleus contains a network of threads which constitute the **chromatin**. Organized into definite organelles called **chromosomes**. The chromatin material mainly consists of **deoxyribonucleic acid (DNA)**, in short). Its main function is to store and transmit hereditary information from one generation to another.

**GROUP DISCUSSION**: Following Content will be discussed in group discussion using **Think Pair Share** Cooperative Strategy

Que 1: Differentiate between chromosome and chromatin material;

Que 2: Enlist various functions of nucleus.
ASSIGNMENT: Differentiate between plasma membrane and cell wall;

DAY 4

EVALUATION: Students will individually appear in formative test 9 for unit 9: Cell using STAD (Student Teams-Achievement Divisions) cooperative strategy.

DAY 5

UNIT 10: CELL ORGANELLES

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Structure of Cytoplasm
- Structure of Mitochondria
- Structure of Endoplasmic Reticulum
- Structure of Golgi Apparatus

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

Que 1: Name different cell organelles present in animal cell.

Que 2: What is fluid content in plasma membrane known as?

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD:

Structure of Cytoplasm: It is the fluid content inside the plasma membrane. It contains specialized cell organelles. Each cell organelles performs a specific function.
Structure of Mitochondria:

**STRUCTURE OF MITOCHONDRION**

**Mitochondria**: "Power house of the cell"

**Discovery**: A Koliber in 1850 first observed mitochondria as granular structures in striated muscles.

**Occurrence**: Mitochondria are found universally in all eukaryotic cells. They are absent in prokaryotes.

**Number**: Their number varies considerably depending upon metabolic activity of the cells. **Number of mitochondria are more in active cells compared to less active cells**. The number of mitochondria in few cells are given below:

**Structure**: Mitochondria are membrane bound organelles with two membranes (outer and inner) and two compartments (intermembrane space and matrix). The outer membrane is smooth and porous while the inner one is folded into a large number of finger like structures called crista. The folds or the cristae increase the surface area of the inner membrane, thereby providing more area for the metabolic reactions to take place.

Structure of Endoplasmic Reticulum:

**Discovery**: Endoplasmic reticulum was discovered by Porter, Cloud and Fullam in 1945, as a network of strands and vesicles in the cytoplasm.

**Occurrence**: It is found in all living organisms except prokaryotes and mature erythrocytes.

**Size**: Structurally endoplasmic reticulum consists of flattened sacs (cisternae), tubules and vesicles.
**Structure**: Endoplasmic reticulum consists of stacks of interconnected cisternae that may be connected to nuclear membrane at one end and cell membrane at the other end. Some tubules may be freely occurring in the cell singly or in groups. Vesicles seems to be associated with **golgi bodies**.

Depending on the presence or absence of ribosomes on the surface of ER; these are of two types.

(i) **Rough ER** (ER with ribosomes, RER)

(ii) **Smooth ER** (ER without ribosomes, SER)

**Structure of Golgi Apparatus**

**Discovery**: It was discovered by camello Golgi, an Italian scientist in 1898 while studying nerve cell in Barn Owl. It is also known as **Golgi body** or **Golgi complex**.

**Occurrence**: Golgi body is found only in eukaryotes i.e plant and animal cells. In a cell golgi body never holds a fixed position, it may be near the nucleus or peripherally positioned.

**Number**: Cells that are active in synthesis generally have many golgi bodies than those cells with less or poor synthesis.

**Structure**: **Golgi body** consist of smooth, flattened, membrane bound (double - walled), sac like structures called **cisternae**. The cisternae are usually placed one above the other (stacked together) in parallel rows. The Golgi apparatus is frequently surrounded by **vesicles** which are discharged from the cisternae.

**GROUP DISCUSSION**: Teacher will ask the students to solve the following two questions by using **Round Robin** cooperative strategy.

- Enlist various functions of Endoplasmic reticulum and Golgi Apparatus
- What will happen to the life of cell if there was no Golgi apparatus?

**ASSIGNMENT**: Write short note on structure of mitochondria, Endoplasmic reticulum and Golgi Apparatus.
DAY 6
UNIT 10: CELL ORGANELLES

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

<table>
<thead>
<tr>
<th>Structure of Lysosomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure of Plastids</td>
</tr>
<tr>
<td>Structure of Vacuoles</td>
</tr>
</tbody>
</table>

**PREVIOUS KNOWLEDGE TESTING:** To stimulate the students of what they already know about the topic

1. Name the cell organelle which is known as power house of the cell.
2. Enlist one major function of Golgi apparatus
3. Name two cell organelles other than that we studied yesterday in class.

**Hybrid Instructional Package: Teaching- Learning Process**

Following content will be presented through CD:

**Structure of Lysosomes:** Lysosomes are waste disposal system of the cell. They are formed by RER. They are membrane bound sac containing digestive enzymes. They help to keep the cell clean by digesting any foreign material as well as poorly working cell organelles. They burst out to digest their own damaged cells.

**Structure of Vacuole:**

**Occurrence**: Vacuoles are universally found in plant cells but are rare in animal cells except protozoa.

**Number**: The number is not fixed, generally a large central vacuole is present in most plant cells. In animal cells vacuoles are small in size and less in number.
Shape and size: There is no definite shape but it generally varies from oval, spherical to irregular size is also highly variable feature ranging from a few μm to 1000 microns.

Structures: Vacuoles are fluid-filled cavities or sacs present in the cytoplasm. They are membrane bound organelles with definite thick wall called ‘tonoplast’.

Functions:

(i) Provide rigidity and turgidity to cells.
(ii) Vacuoles act as store houses of pigments and waste products, as well as useful minerals and salts.
(iii) In many cases where vacuoles hold air in their spaces, they are supposed to help in buoyancy of the cells.

Structure of Plastids:

Plastids are present only in plant cells. There are two types of plastids:

Chromoplasts: Coloured plastids that provide colour to leaves and flowers.

Leucoplasts: White plastids that store starch, oils and proteins granules.

Plastids also have their own DNA and ribosomes. Therefore they are capable of making some of their proteins.

GROUP DISCUSSION: After the content presentation through CD, Students will be engaged in group discussion using Three Minute Review cooperative strategy

GROUP DISCUSSION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy

1. Why lysosomes are known as suicidal bags?
2. Name two cell organelles which have their own DNA and ribosomes.

ASSIGNMENT: Write short note on the structure of lysosomes, vacuoles and plastids.

DAY 7

EVALUATION: Students will individually appear in formative test 10 for unit 10: Cell Organelles using STAD (Student Teams-Achievement Divisions) cooperative strategy

DAY 8

Teacher will take posttest of Summative Test V
宗合指导性课程

Appendix A-3 (vi)

MODULE VI (BIOLOGY)

PLANT TISSUE

Content Sequence:

Unit 11: Plant Tissue- I

• Differentiation
• Classification of Plant Tissues
• Meristematic Tissue: Location and Function of Apical Meristem, Intercalary Meristem and Lateral Meristem.
• Permanent Tissue: Structure and Function of Parenchyma, Collenchyma and Sclerenchyma

Unit 12: Plant Tissue- II

• Complex Permanent Tissue
• Vascular Bundles
• Xylem: Structure and Function
• Phloem: Structure and Function
• Protective Tissue- Epidermis and Cork
• Stomata: Structure and Function

Enduring Understanding

Cell is the basic structural and functional unit of life. Some plants and animals (e.g. amoeba, paramecium) are made up of single cell; while others consist of large number of cells. Unicellular organism performs all the functions of life with one cell only. In multicellular organism, however, cells become specialized to perform different functions. These functions are taken up by different groups of cells known as tissues. As plants and animals have different characteristics, they have different types of tissue that help them to carry their functions. The structural organisation of organ and organ systems is far more specialized and localized in complex animals than even in very complex plants.

Behavioural Objectives of the module: Listed in Table 3.2 of Chapter 3

DAY 1

Teacher will hold pretest of Summative Test VI followed by brief introduction of the Module VI
DAY 2
UNIT 11: PLANT TISSUE-I

WARM UP: To establish rapport between teacher and student
List of objectives for the topic to help focus the learning:

- Differentiation
- Classification of plant tissue
- Meristematic Tissue: Apical, Lateral and Intercalary meristems

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. Differentiate between plant cell and animal cell
2. What are the basic differences between plants and animals?
3. What is tissue?

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD:

Differentiation: It is the process by which cells are specialized to do specific functions and form permanent tissue.

PLANT TISSUES
Plant tissues are of two main types:
(i) Meristematic tissues which consists of undifferentiated actively dividing cells.

(ii) Permanent cells which consist of differentiated cells which have last the ability to divide.

Meristematic tissue
Meristematic tissue, commonly called meristem, is composed of cells which are immature, not fully differentiated ones, and which possess the power of cell division. The cells are compactly arranged and lack intercellular spaces. The cells contain a prominent nucleus and dense cytoplasm.

Function: They bring about increase in length and girth of the plant body.
Classification of Meristems:

**Apical meristem**: It occurs at the apices of stems and roots of a vascular plant. Growth, in length of the axis, entirely due to their activities; so they are also called growing points.

**Lateral Meristem**: They occur on the sides almost parallel to the long axis of root, stem and its branches. It brings about an increase in the width or girth of the organs.

**Intercalary meristem**: They occur at the base of the internodes in monocots (grasses). It brings about increase in length of the internode.

**Permanent tissues**: Meristematic cells gradually differentiate and become mature or permanent. Permanent tissue is thus composed of cells in which the growth has stopped.

Depending on the type of cells permanent tissues are of two types: -

**Simple tissue**: Composed of a single type of cells, like parenchyma, collenchyma and sclerenchyma.

**Complex tissue**: Composed of different types of cells, like xylem and phloem.
GROUP DISCUSSION: Following Content will be discussed in group discussion using **Think Pair Share** Cooperative Strategy

1. What is unique feature of meristems
2. Differentiate between meristematic tissues and permanent tissues.

ASSIGNMENT: Diagrammatically locate the position of various meristems in plant and discuss their functions.

DAY 3

UNIT 11: PLANT TISSUE-I

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Simple permanent tissue: Classification
- Parenchyma tissue, Collenchyma tissue and Sclerenchyma tissue

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. Where are the apical meristems located?
2. What is the function of intercalary meristems?
3. What is simple permanent tissue?

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD:

Simple permanent tissues are of three types:

- Parenchyma tissue
- Collenchyma tissue
- Sclerenchyma tissue

These three are discuss in detail in the following table:
<table>
<thead>
<tr>
<th>Characters</th>
<th>Parenchyma</th>
<th>Collechyma</th>
<th>Sclerenchyma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell wall</td>
<td>Cell wall thin, made up of cellulose.</td>
<td>Cell wall made up of cellulose, unevenly thickened at corners.</td>
<td>Cell wall made up of lignin.</td>
</tr>
<tr>
<td>Nature</td>
<td>Permanent tissue</td>
<td>Supporting tissue</td>
<td>Mechanical tissue</td>
</tr>
<tr>
<td>Living or dead</td>
<td>Cells are living.</td>
<td>Cells are living.</td>
<td>Cells are dead.</td>
</tr>
<tr>
<td>Shape of cells</td>
<td>More or less isodiametric but round, oval or polygonal in transverse sections.</td>
<td>Somewhat elongated, in transverse sections appears round or polygonal.</td>
<td>Long, narrow and pointed at both ends in transverse section appears polygonal.</td>
</tr>
</tbody>
</table>
| Function | • Storage of water and food material.  
• Storage of water in succulents. | • Storage and giving tensile strength.  
• When present on margins of leaves, resists tearing effect of wind. | • Give strength and rigidity.  
• Help in conduction of water when associated with xylem. |

- Provides rigidity due to turgidity and helps maintain the shape of the body.  
- Gives rise to secondary meristem in the form of cork cambium and vascular cambium.  
- Performs vital activities of plant.

- Some posses chloroplast and perform photosynthesis.

| Occurrence | Present in all soft parts of plants. Parenchyma in leaves contains chloroplasts called chlorenchyma. Parenchyma enclosing airspaces is aerenchyma. | Found just below outermost layer of herbaceous stem and petiole but never present in roots and monocots, with few exceptions. | Form hard parts of plants; found in isolated masses in pulp of fruits such as guava, pear, etc. |
**GROUP DISCUSSION:** Following Content will be discussed in group discussion using *Think Pair Share* Cooperative Strategy

1. Name the tissues that:
   - (i) stores food and water in plants
   - (ii) provides flexibility to plants
   - (iii) makes plant hard and stiff
   - (iv) makes hard covering of seeds and nuts
   - (v) is present in veins of leaves.

**ASSIGNMENT:** Differentiate between parenchyma, collenchymas and sclerenchyma tissues.

**DAY 4**

**EVALUATION:** Students will individually appear in formative test 11 for unit 11: Plant Tissue-I using *STAD (Student Teams-Achievement Divisions)* cooperative strategy

**DAY 5**

**UNIT 12: PLANT TISSUE-II**

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Comple Permanent Tissue
- Structure and function of Xylem
- Structure and function of Phloem

**PREVIOUS KNOWLEDGE TESTING:** To stimulate the students of what they already know about the topic

1. What are permanent tissues?
2. Name different types of permanent tissue
3. How is simple permanent tissue different from complex permanent tissue.
Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD:

Complex permanent tissues: These are heterogenous in nature. Being composed of different types of cell elements. Xylem and phloem are complex tissues, which constitute the component parts of the vascular bundle. They are also called vascular tissues.

Complex tissue are of two types: Xylem and Phloem

Structure of Xylem

Xylem: Xylem is a complex tissue, primarily instrumental for conduction of water and solutes and also for mechanical support. The tissues composing xylem are tracheids, tracheae or vessels, fibres called xylem fibres or sclerenchyma or wood fibres, and xylem parenchyma.

Tracheids: A tracheid is a very much elongated cell occurring along the long axis of the organ. Trached's wall is hard, moderately thick and usually lignified. Secondary walls are deposited in different manner, so that the tracheids may be annular, spiral, reticulate, scalariform or pitted. These are found in pteridophytes and gymnosperms. The function of tracheids is to conduct water and dissolved mineral elements from roots to leaves. They also provide mechanical support.

Tracheae or vessels: These are long tube like bodies ideally suited for the conduction of water and solutes. A trachea or a vessel is formed from a row of cylindrical cells arranged in longitudinal series where the partition walls become perforated, so that the whole thing serves like a tube. They are found in angiosperms, but do not occur in some xerophytes, parasites and aquatic plants.

Xylem sclerenchyma: Some fibres (sclerenchyma) remain associated with other elements in the complex tissue, xylem, and they mainly give mechanical support.

Xylem parenchyma: Living parenchyma is a constituent of xylem of most plants. These are only living cells in xylem. These cells are particularly meant for storage of starch and fatty food. Other matters like tannins, crystals, etc. may also be present. As a constituent part of xylem, they are also possibly involved in conduction of water and solutes and mechanical support.

Teacher will revise the structure and function of xylem with traditional teaching.

GROUP DISCUSSION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy

1. Differentiate between tracheids and vessels

Structure of Phloem

Phloem: The other specialized complex tissue forming a part of the vascular bundle is phloem. It is composed of sieve elements, companion cells, parenchyma and fibres. The phloem is chiefly instrumental for translocation of organic solutes, the elaborated food materials in solution.

Sieve elements: Sieve element is the main component of the phloem. Sieve elements are of two types: Sieve cells and sieve tube members.

Sieve cell: Sieve cell is special kind of cell, which possesses sieve areas in its lateral walls. There is no specialized sieve plate in it. Sieve cells are usually found in pteridophytes and gymnosperms.

Sieve tube member: Sieve tube member is a special kind of cell in which the sieve areas are localized on its end walls. Sieve tube members are placed one above the other forming a continuous tube called sieve tube. These are found in angiosperms.
Companion cells: They remain associated with the sieve tubes of angiosperms. These are smaller, elongated cells, having dense cytoplasm and prominent nuclei. Their final association is evident from the fact that companion cells continue to enhance the sieve tubes' function and die when sieve tubes are disorganized.

Phloem parenchyma: A good number of parenchyma cells remain associated sieve elements. These are living cells with cellulose walls having primary pit fields. They are mainly concerned with storage of organic food matters. Tannins, crystals and other material may also be present. This is absent in monocots.

Phloem sclerenchyma or bast fibres: These are typical elongated cells having interlocked ends, lignified walls with simple pits. They are of considerable importance, as these fibres are abundantly used for manufacturing of ropes and cords.

Teacher will revise the structure and function of xylem with traditional teaching.

GROUP DISCUSSION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy

1. Differentiate between xylem and phloem.

ASSIGNMENT: Explain the structure of phloem with well labeled diagram.
Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD:

**Protective Tissue**
They are primarily protective in function and include epidermis and cork.

**Epidermis**
It originates from apical meristem and forms the outermost covering of plant organs which comes in direct contact with the environment. The epidermal cells vary in shape and size, and are compactly arranged to form a continuous layer. This layer is only interrupted by stomata. Mostly, it is single-layered, but is two-layered in Ficus elastica and multilayered in Peperomia pereskiaefolia. It can be differentiated as velamen (of aerial roots, to absorb moisture), motor cells (of leaves of grasses which help in folding and unfolding of leaves), cork cells or silica ceils (Gramineae), etc.

**Cuticle**
Cuticle is deposited over outer surface of epidermal cells. It is made up of a fatty substance, called cutin.

**Wax**
Cuticle is generally covered with wax. It is deposited in the form of granules, rods, crusts, viscous semiliquid masses, etc.

**Stomata** (singular: Stoma)
A stoma consists of two kidney-shaped guard cells enriching a pore. The guard cells are smaller than epidermal cells. The guard cells have thin wall towards epidermal cells. The guard cells are elastic in nature. The adjoining cell walls of two guard cells are not attached to each other so as to stretch laterally during stomatal opening. On the average a stomatal pore is 20 m long and 10 - 20 m in width. Stomata perform the following functions.
- Help in exchange of gases like oxygen and carbon dioxide between the atmosphere and the plant.
- Help in loss of water from the plant into the outside atmosphere (transpiration)

**Cork**
The epidermal tissue at the periphery in old roots and stems are replaced by cork. The cork cells are dead and lack intercellular spaces. The walls of cork cells are thickened by the deposition of suberin. This makes the cells impermeable to water and gases.

**Functions**
Cork prevent water loss from the plant body and also prevent infection and mechanical injury.
GROUP DISCUSSION: After the content presentation through CD, Students will be engaged in group discussion using **Three Minute Review** cooperative strategy.

**GROUP DISCUSSION:** Following Content will be discussed in group discussion using **Think Pair Share** Cooperative Strategy

1. Why are protective tissues important for plant?
2. How does cork act as a protective tissue?

**ASSIGNMENT:** Discuss the structure and function of stomata with well labeled diagram.

**DAY 7**

**EVALUATION:** Students will individually appear in formative test 12 for unit 12: Plant Tissue-II **STAD (Student Teams-Achievement Divisions) cooperative strategy**

**DAY 8**

Teacher will take posttest of Summative Test VI
Content Sequence:

Unit 13: Animal Tissue - I

- Classification of Animal Tissues
- Muscle Tissue: Structure and Function of Striated muscles, Unstriated muscles and Cardiac muscles.

Unit 14: Animal Tissue - II

- Connective Tissue: Structure and Function of the following-
  - Loose Connective Tissue Proper: Adipose and Areolar Tissue
  - Compact Tissue Proper: Tendon and Ligament
  - Supportive Connective Tissue: Cartilage and Bone
  - Fluid Connective Tissue: Blood and Lymph
  - Nervous Tissue: Structure and Function

Enduring Understanding

The structural organisation of organ and organ systems is far more specialized and localized in complex animals than even in very complex plants. On the basis of the functions they perform, animals have different types of tissues, such as epithelial tissue that is protective in nature and surrounds various organs; connective tissue that plays the role of transporter; muscle tissue that is responsible for the movement of body; and nervous tissue to carry impulses from various parts to the brain and vice versa.

Behavioural Objectives of the module: Listed in Table 3.2 of Chapter 3

DAY 1

Teacher will hold pretest of Summative Test VII followed by brief introduction of the Module VII
DAY 2
UNIT 13: ANIMAL TISSUE-I

WARM UP: To establish rapport between teacher and student
List of objectives for the topic to help focus the learning:

- Classification of Animal Tissues
- Structure and Function of Squamous Epithelium and Stratified Squamous Epithelium
- Structure and Function of Columnar Epithelium and Cuboidal Epithelium
- Structure and Function of Glandular Epithelium and Sensory Epithelium

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. Name the largest organ in human body.
2. How does skin act as protective tissue?

Hybrid Instructional Package: Teaching- Learning Process

Following content will be presented through CD:

Animal Tissues
In animals, four basic types of tissues are found.
(i) Epithelial tissue
(ii) Connective tissue
(iii) Muscular tissue
(iv) Nervous tissue

EPITHELIAL TISSUE
Epithelial tissue forms the covering and lining of body organs. It covers the body from outside and also lines various cavities inside. Epithelial tissue mainly consists of sheets of cells termed as epithelium. The cells are connected to each other by intercellular cement. It is supported by a basement membrane, which is made up of a network of white non-elastic collagenfibers. The basement membrane provides elastic support to the cells.

The epithelium is present on the surface of the body and protects the body from friction and drying. Epithelium lining the body cavity is smooth, which enables gliding. Epithelium is of different types. These types are discussed below.
Hybrid Instructional Modules

Squamous epithelium:
Squamous epithelium consists of flat scale-like cells. It is also called pavement epithelium because cells of this epithelium fit together like the stones of a pavement. Its surface appears like mosaic. It is found in peritoneal lining of coelom covering of heart, blood vessels, endothelium, alveoli of lungs, etc. The cell of squamous epithelium contains a centrally located, flattened nucleus. The margin of the cell is mostly serrated, but can also be smooth. The squamous epithelium is present in the peritoneum and the pericardial membranes. The squamous epithelium is called endothelium when it lines the heart, blood vessels and lymph vessels.

Columnar epithelium:
Columnar epithelium consists of tall column-shaped cells. They rest on a basement membrane. The nucleus is oval in shape and aligns itself along the long axis of the cell. It is generally found near the basal part of the cell. The free end of the cell may consist of granules or zymogen and mucin droplets. The columnar epithelium is present in intestine and kidney tubules. It has a brushed border or a striated border. This brush border consists of numerous finger-like projections called microvilli, as seen under an electron microscope. These increase the area of absorption. Simple columnar epithelium is found on the lining of stomach and intestine of vertebrates.

Cuboidal epithelium:
Cuboidal epithelium consists of single layer of cells with more or less squarish profiles and centrally placed round nuclei. It is found in glands such as liver, thyroid, mammary glands, salivary glands, etc. It also lines the bronchioles of lungs.
Ciliated epithelium:
This epithelium usually consists of cuboidal or columnar cells. It has numerous, thin, delicate hair like projections called cilia arising from the free outer surface of the cell. It is found in the lining of wind pipe, kidney tubules and oviduct.

Stratified epithelium:
The stratified epithelium consists of two or more layers of epithelial cells. The lowermost layers rest on the basement membrane. This epithelium is exposed to wear and tear and provides good protection from friction. It is found in epidermis of skin, lining of mouth cavity, tongue, oesophagus and vagina.

Sensory epithelium:
It consists of epithelial cells that are modified to receive stimuli and generate nerve impulses.
Example:
• Taste buds of tongue (sense of taste)
• Cells of mucous membrane of nose (sense of smell)
• Rods and cones of retina (sense of vision)
• Cells of internal ear (auditory senses)

GROUP DISCUSSION: Following Content will be discussed in group discussion using Number Head Together Cooperative Strategy
1. Name the place where the following tissues are located:
   (i) Squamous epithelium
   (ii) Columnar epithelium
   (iii) Cuboidal epithelium
   (iv) Stratified squamous epithelium

GROUP DISCUSSION: Following Content will be discussed in group discussion using Round Robin Cooperative Strategy
1. Enumerate various functions of epithelial tissue.
**Assignment:** Discuss various types of epithelial tissue with special reference to their location and function.

**Day 2**

**Unit 13: Animal Tissue-I**

**Warm Up:** To establish rapport between teacher and student.

List of objectives for the topic to help focus the learning:

- Muscle Tissue
- Striated Muscle
- Unstriated Muscle
- Cardiac Muscle

**Previous Knowledge Testing:** To stimulate the students of what they already know about the topic.

1. Name the tissue responsible for movement in human body.
2. Name the organ which works throughout life and is defatigable.
3. Name the tissue that is present in heart.

**Hybrid Instructional Package: Teaching-Learning Process**

Following content will be presented through CD:

**Muscle Tissue**

Muscular tissue is a contractile tissue consisting of large elongated cells or fibres. The cytoplasm of a muscle cell consists of a large number of fine longitudinally running fibres called myofibres. The cytoplasm is called the sarcoplasm.

There are three types of muscular tissues or muscles in the body of vertebrates:

(i) Smooth or involuntary muscle
(ii) Skeletal (striated) or voluntary muscle
(iii) Cardiac or heart muscle
Smooth or involuntary muscles:
The smooth muscle consists of long, spindle-shaped cells arranged in layers.
Each cell contains a centrally placed ovoid nucleus. The cytoplasm contains longitudinally arranged myofibrils, which are composed of myosin and actin.
Each cell is 15 to 200μ in length and 5.8μ in diameter. A membrane called sarcolemma binds the muscle fibre. The smooth muscles have the ability of slow, prolonged contractions. These contractions are of two types, wherein the entire cell may contract or only a part of the cell contracts. The contraction of this muscle is not under contraction of will, and hence called involuntary muscle.
It is found in the wall of alimentary canal, and also in various organs such as gall bladder, ureter, urinary bladder, uterus and oviduct.

Skeletal muscles or voluntary muscles:
These muscles regulate the movement of skeleton and hence are called as skeletal muscles. They are voluntary muscles as they can be moved according to our will. When viewed under microscope, they show striations and hence are called as striated muscles.
Each muscle is made up of many muscle fibres or cells grouped together in bundles called fasciculi. The fibres are 1 mm to 4 cm long and 10 to 100 μ in diameter. A membrane called sarcolemma, which is surrounded by basement membrane that covers each fibre. The fibre is made up of many fibrils called myofibrillae, i.e. it has many nuclei. The nuclei are found beneath the sarcolemma.
These muscles show alternating light and dark bands, which are confined to myofibrillae. The dark band or anisotropic band (A band or Q band) is bisected by a thin, light line called the Henson’s line or ‘H’ line. The light band or isotropic band (I band or J band) is bisected by dark line called as Krause’s membrane or ‘Z’ line. The area between two ‘Z’ lines is called sarcomere. The thick filament is made up of myosin, whereas thin filaments are made up of actin.
As the name suggests, the skeletal muscles are found attached to the skeleton.
Cardiac muscles:
The cardiac muscles are exclusively found in the heart. These muscles also have light and dark bands similar to skeletal muscles. The muscle fibre consists of branched muscle cells, which meet end to end. At the junction of two cells, there occur intercalated disc. This muscle fibre also contains many nuclei. There is one nucleus in each cell. The cardiac muscle is involuntary, i.e. they do not contract according to our will. In fact, they contract rhythmically.

GROUP DISCUSSION: After the content presentation through CD, Students will be engaged in group discussion using Three Minute Review cooperative strategy

GROUP DISCUSSION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy

1. Differentiated between striated muscles and cardiac muscle on the basis of their nucleus and occurrence.

ASSIGNMENT: Discuss different types of muscle tissue with well labeled diagram

DAY 4

EVALUATION: Students will individually appear in formative test 13 for unit 13: Animal Tissue-I STAD (Student Teams-Achievement Divisions) cooperative strategy
Hybrid Instructional Modules

DAY 5
UNIT 14: ANIMAL TISSUE-II

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

<table>
<thead>
<tr>
<th>Connective Tissue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loose Connective Tissue Proper: Adipose and Areolar Tissue</td>
</tr>
<tr>
<td>Compact Tissue Proper: Tendon and Ligament</td>
</tr>
<tr>
<td>Supportive Connective Tissue: Cartilage and Bone</td>
</tr>
</tbody>
</table>

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. Where do fats get stored in human body?
2. How are bones connected to muscle?
3. How is one bone connected to other bone?

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD:

CONNECTIVE TISSUE
This tissue serves to connect or bind the cells of other tissues in the body, and gives them rigidity and support. It is composed of cells and numerous, thick structures called fibres. The cells are living and are embedded in a non-living, intercellular matrix. Based on the nature of matrix, the connective tissues are divided into three general types:
- Connective tissues proper - Where the matrix is relatively less rigid.
- Supportive connective tissue - Where the matrix is rigid.
- Fluid Connective tissues - Where the intercellular matrix is fluid called plasma.

<table>
<thead>
<tr>
<th>Connective Tissues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loose Connective Tissue Proper</td>
</tr>
<tr>
<td>Compact Connective Tissue Proper</td>
</tr>
<tr>
<td>Supportive Connective Tissue</td>
</tr>
<tr>
<td>Fluid Connective Tissue</td>
</tr>
</tbody>
</table>

| Areolar |
| Adipose |
| Tendon |
| Ligament |

Blood |
Lymph
Hybrid Instructional Modules

(a) Areolar connective tissues
Areolar connective tissue shows seemingly empty space and loosely organized fibres. All the six cell types are found in areolar tissue, in which fibroblasts are abundant. The fibres run in random directions, which are mostly collagenous. However, elastic and reticular fibres are also present. Areolar tissue is highly vascular and hence, WBCs can move freely in the tissue. Generally, all epithelia rest on areolar tissue. It is the most widely distributed connective tissue in the body having irregular shaped cells in the matrix and two kinds of fibres - white fibres (made of collagen) and yellow fibres (made of elastin) are present.

Function: - This tissue binds the skin with underlying parts.

Adipose tissue
The cytoplasm of the cells of adipose tissue contains fats. Connective tissue fibres are present within the matrix in-between these cells. Each cell contains a large fat droplet. The nucleus is at the centre of the cell in early stages and fat droplets are small and numerous. These droplets coalesce eventually to form a large single droplet of fat. The cytoplasm is restricted only to the periphery. This gives a signet ring-like appearance to the cell. The adipose tissue is found in subcutaneous tissue, in mesenteries, in the covering of heart, around the blood vessels and kidneys. The adipose tissue acts as a food reserve.

Function: It also prevents heat loss from the body and stores fat.

Tendon: Tendon is tough and non elastic made up of white fibres and connect muscle to bones.
Ligaments: Ligaments are strong, elastic consisting of yellow fibres. They connect one bone to another bone.

Bone: It forms framework of body and supports the body. It is hard, strong and non flexible tissue. These are embedded in hard matrix that is composed of calcium and phosphorous compounds. It is the hardest tissue.

Cartilage: It is flexible, solid matrix made up of proteins and sugars. It has widely spaced cell. It is present in nose, ear, tracheids and larynx.

GROUP DISCUSSION: After the content presentation through CD, Students will be engaged in group discussion using Three Minute Review cooperative strategy.
**GROUP DISCUSSION:** Following Content will be discussed in group discussion using **Think Pair Share** Cooperative Strategy

1. Differentiate between tendons and ligament.
2. Differentiate between bone and cartilage.

**ASSIGNMENT:** Discuss the structure and function of connective tissue proper and supportive connective tissue.

**DAY 6**

**UNIT 14: ANIMAL TISSUE-II**

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Fluid Connective Tissue: Bone and Lymph
- Nervous tissue

**PREVIOUS KNOWLEDGE TESTING:** To stimulate the students of what they already know about the topic

1. Name the organ that helps in exchange of gases in human body.
2. How does oxygen reach different parts of human body.
3. Name the tissue that connects different organs of human body.

**Hybrid Instructional Package: Teaching- Learning Process**

Following content will be presented through CD:

**Fluid connective tissue:**
Blood and Lymph constitute the fluid tissue and consist of cells and matrix without fibres. Matrix is in a fluid state and is called plasma.

**Blood**
Blood is a bright red coloured fluid connective tissue. It consist ofa straw coloured fluid called plasma in which various kinds of cells are present..

**The Blood cells are : -**
(i) Erythrocytes (red blood cells or RBCs in short)
(ii) Leucocytes (white blood cells or WBC in short)
(iii) Platelets.
Lymph

The lymph is yellow in colour, as it does not contain haemoglobin. Lymph (fluid in the intercellular spaces) resembles blood plasma, except that lymph is devoid of blood platelets. It consists mostly of water with dissolved salts and proteins. The lymph enters the bloodstream near the heart. Lymph flows in one direction - from tissues to heart. It helps in the exchange of materials between blood and tissue fluids.

GROUP DISCUSSION: Following Content will be discussed in group discussion using Think Pair Share Cooperative Strategy

1. Why is blood known as connective tissue?
2. Differentiate between blood and lymph.

GROUP DISCUSSION: Following Content will be discussed in group discussion using Round Robin Cooperative Strategy

1. Enlist various functions of Blood.

NERVOUS TISSUE

Nervous tissue is a specialised tissue for receiving stimuli and transmitting messages. It is found in the brain, spinal cord and nerves. The functional units of nervous tissues are nerve cells or neurons. Each neuron consists of three parts.

(i) The main body called the cell body or cyton.
(ii) The dendrons
(iii) The axon

Dendrons: The dendron are one or more hort processes arising from the cyton. They further branch to form thin dendrites. Dendrites receive impulses.

Axon: The axon is a single, long, cylindrical process arising from the cyton. The axon forms fine branches at its terminal end takes impulses away from the cell body.

Function: The nerve fibres conducts messages from one part of the body to the other. They also receive stimuli from outside environment and send message to brain and spinal cord.

GROUP DISCUSSION: After the content presentation through CD. Students will be engaged in group discussion using Three Minute Review cooperative strategy.

ASSIGNMENT: Discuss the structure of nervous tissue with well labelled diagram.

DAY 7

EVALUATION: Students will individually appear in formative test 14 for unit 14: Animal Tissue-II STAD (Student Teams-Achievement Divisions) cooperative strategy

DAY 8

Teacher will take posttest of Summative Test VII
Content Sequence:

Unit 15: Work

- Physical and Mental Work
- Work done by Constant Force
- Work done when the object moves at an angle to the direction of the force
- Positive work, Negative work and Zero work
- Work done against Gravity
- Numericals

Unit 16: Kinetic Energy

- Concept of Energy
- Mechanical Energy
- Kinetic Energy
- Derivation of Kinetic Energy
- Relationship between Kinetic Energy and Momentum
- Numericals

Enduring Understanding

The physical meaning of term ‘work’ is different from its daily life meaning. For example a student learning his lesson is not doing any work, a person carrying a load on his head and even a teacher teaching in a class is not doing any work. In the language of physics, Work is said to be done when the force applied on the body displaces the body in the direction of the applied force. We know from our daily life experiences that work and energy are inter-convertible. For doing work, energy is always consumed. When a body is capable of doing more work, it is said to possess more energy and vice versa. We have various forms of energy such as potential energy, kinetic energy, heat energy, chemical energy, electrical energy and light energy. In daily life we have seen that moving objects can do work. For example, a bullet can pierce a target, moving wind moves the blades of wind mill etc. thus the objects in motion possess energy and this type of energy is called kinetic energy.

Behavioural Objectives of the module: Listed in table 3.2 of Chapter 3
Hybrid Instructional Modules

DAY 1

Teacher will take pretest of summative test VIII followed by brief introduction of the module VIII.

DAY 2

UNIT 15: Work

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Physical and mental work
- Mechanical work
- Work done when the force is applied and object moves
- Work done when the force is applied and object does not get displaced
- Work done when object gets displaced in the absence of a force acting on it
- Work done by a constant force
- Numericals

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

5. Consider the following activities and tell whether the work is done in these cases or not:
   1) Watching television
   2) Pushing a wall
   3) Holding a bucket of water
   4) Climbing a tree
   5) Lifting a weight from ground level to certain height

Hybrid Instructional Package: Teaching- Learning Process

Following content will be presented through traditional teaching:

The work has different meaning in day-to-day life than in physics. In the above activities work is done. This work can be classified in two different ways:

1. Physical and mental work
2. Mechanical work

box
1. Physical work and mental work:

(1) Pushing a huge rock or a wall, holding a bucket full of water in hand, a person carrying load on his head, are examples of physical work. In all these cases one may be exerting a large force on the wall/rock, but the wall/rock does not move from its position or does not get displaced. So no work is done in such cases.

(2) Watching television for many hours, students attending the class, child preparing for his/her exams are examples of mental work. In all these mental and physical exertion is there. But in terms of science no work is done because force is not causing any displacement.

2. Mechanical work:

This includes climbing up the steps of staircase or tree, a person lifting a weight from the ground level to a certain height. In all these cases when a force is exerted on an object it gets displaced.

According to law of physics work is being done, when:

(i) A force should act on the object

(ii) The applied force must produce a displacement

Following content will be presented through CD

1. Work is done when force is applied and object moves:

1. A bullock is pulling a cart. The cart moves. The force is applied by the bullock and the cart is displaced. So, the work is done by the bullock on the cart.

2. A spring is stretched by a person.

In this situation when the force is applied by the person the spring gets stretched. So, the work is done by the person on the spring.

3. When a gas is heated the piston of the gas container lifts upward and the work is done by the molecules of the gas on the piston.
Situations when the object is not displaced in spite of force acting on it.

1. If a person is trying to push a wall then the wall does not shift from its place, the displacement is zero in this case and hence the work done on the wall is also zero but the work done by the person is not zero because when pushing the wall his muscles are getting stretched due to which heart has to pump more blood to the stretched muscles.

2. If a person is carrying some load on his head and moves on a horizontal path, the work done by the person on the load is zero. In such a case the person is definitely doing some work because heart has to work more in order to pump more blood to the stretched muscles.

Following content will be presented through traditional teaching:

When an object gets displaced in the absence of force acting on it:

1. **Motion of earth around sun in a circular path:** Here the force of gravity between the two is perpendicular to the direction of motion and hence no work is done.

2. **An artificial satellite moving around the earth:** Here the force of gravity between the two provides necessary centripetal force which acts at right angles to the direction of the motion, hence the force of gravity of earth does no work on the satellite.

**GROUP DISCUSSION:** Following content will be discussed in group discussion using Think Pair Share Cooperative Strategy

Teacher will ask the students to reason out whether or not work is done in the listed activities in the listed activities in the light of your understanding of the term work.

1. A wind mill is lifting water from a well
2. An engine is pulling a train
3. Food grains are getting dried in the sun
Work done by a constant force:

If a constant force \( F \) is applied to a body with the result that the body is displaced through a distance \( s \) in the direction of the force, then the work done \( W \) by the force \( F \) is defined as the product of the force applied i.e. \( F \) and the displacement of the body from its initial position. In that case:

\[
W = F \times S
\]

Work is a scalar quantity i.e. it has only magnitude but no direction. The SI unit of work is Newton metre (Nm) or joule (J)

If \( F = 1 \) newton \( \& S = 1 \) metre

\[
W = 1N \times 1m = 1Nm
\]

Or, \( W = 1J \)

Definition: If on applying a force of 1N the object gets displaced by 1m in the direction of force, the work done is said to be one joule.

- Cgs unit= ergs
  
  1 Joule= \( 10^7 \) erg

Numerical 1: Find out work done, when a force of 20 N displaces a body through 8m, in the direction of applied force.

Solution: \( W = F \times S \)

\[
W = 20N \times 8m = 160Nm
\]

Assignment: 250 Joules of work is done when a force of 50 n is applied on an object. Calculate the distance through which the object moves and also state its direction.
DAY 3
UNIT 15: Work

WARM UP: To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Factors on which work done depends
- Work done when the object moves at an angle to the direction of the force
- Positive work, Negative work, Zero work

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. Define work in terms of physics.
2. What is S.I unit of work?
3. What are the conditions for work to be done?

Hybrid Instructional Package: Teaching- Learning Process

GROUP DISCUSSION: Following content will be discussed through group discussion using Think Pair Share Cooperative Strategy

1. What will happen to work done when force is increased?
2. What will happen to work done when distance is increased?

Following content will be discussed through traditional teaching

Work done when the object moves at an angle to the direction of the force

Let us consider a child pulling a toy dog. He applies a force on the toy along the direction of the string which is tied to the toy dog. The force acts at an angle $\theta$ with the horizontal and toy dog moves through a distance, $s$' along the horizontal.

In order to calculate the work done, we should know the magnitude of force applied in the direction of motion.
Hybrid Instructional Modules

Mathematically, Force (which caused the motion) is equal to \( F \cos \theta \)

Where, \( F \) = Applied force
\( \theta \) = angle between applied force and the Direction.

Thus substituting the values in equ.
\[ W = \text{Component of force} \times \text{displacement} \]
\[ W = (F \cos \theta) \cdot S \]
\[ W = F \cdot s \cdot \cos \theta \]

This Equation can be used to find the work done when object moves in a different direction from that of force, thus making work done (i) Positive (ii) Negative (iii) Zero

Following content will be discussed through CD

1. Positive work done:
   If the force applied to the body and the displacement of that body are in the same direction, the work done by the force is called positive work done.

   For example:
   (i) **Stretching a spring**: In stretching of a spring, both the stretching force and the displacement act in the same direction.
   (ii) **Lifting a weight upwards**: In lifting a weight upwards work is done by exerting an upward force.
   (iii) **Object falling freely under the influence of gravity**: For the object falling under the influence of gravity, gravity is pulling the object so gravitational force and the displacement are in the same direction.

2. Zero work done:
   If the force applied to the body and the displacement of that body are perpendicular to each other then work done by the force is called zero work done.

   For example:
   (i) If a body moves in a circular path with constant speed, then at every point of circular path centripetal force and the displacement are perpendicular to each other. So work done by centripetal force is zero.
(ii) Similarly, in the motion of the earth around the sun, the directions of the displacement and the force are 90° to each other. So, no work is done on a body when it moves along a circular path.

(iii) A person holding a suitcase on his head moves on the horizontal road, the work done is zero. This is because the force applied by the person to hold the suitcase on his head is perpendicular to the horizontal distance travelled by the person.

3. Negative work:
   If the force is applied to a body and the displacement of the body is in opposite direction to that of the force applied then work done is called negative work.
   For example:
   (i) Work done by frictional force is always negative when brakes are applied to a moving car, braking force and the displacement are in the opposite direction ($\theta = 180^\circ$).
   (ii) When a body is lifted, the work done by the gravitational force acts in vertically downwards direction and the displacement takes place in the vertically upward direction.

**GROUP DISCUSSION:** After the content presentation, students will be engaged in group discussion using *Three-Minute Review* cooperative strategy

**GROUP DISCUSSION:** Teacher will ask the students to discuss using *Think Pair Share* Cooperative Strategy

A boy throws a rubber ball vertically upwards. What type of work, positive or negative, is done:

(a) by the force applied by the boy?

(b) by the gravitational force of the earth?

**ASSIGNMENT:** Define (1) Positive work (2) Negative work (3) zero work. Give one suitable example of each.

**DAY 4**

**UNIT 15: Work**

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Work done against gravity
- Numericals

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PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. In each of the following three cases a force, \( F \) is acting on an object of mass, \( m \). The direction of displacement is from west to east shown by longer arrow. Observe diagram carefully and state whether the work done by the force is negative, positive or zero.

   \( (1) \) \( (2) \) \( (3) \)

Hybrid Instructional Package: Teaching- Learning Process

Following content will be discussed through traditional teaching

Work done against gravity:

If we lift a book from the table, we do work against the force of gravity. While doing so the force required to lift the body is equal to its weight.

So, whenever work is done against gravity, the amount of work is equal to the product of weight of the body and the vertical distance through which the body is lifted.

Suppose a body of mass \( m \), is lifted vertically upwards through a distance \( h \). In this case, the force required to lift the body will be equal to weight of body + \( mg \),

where \( g \) = acceleration due to gravity

\[ \therefore \text{Work in lifting body} = \text{weight of body x vertical distance} \]

\[ W = m \times g \times h \]

This formula is used in all those cases where the object is being lifted upwards, against the force of gravity.

Numerical:

Q 1. A child pulls a toy car through a distance of 10 m on a smooth horizontal floor. The string held in child’s hand makes an angle of 60° with the horizontal surface. If the force applied by the child be 5 N, calculate the work done by the child in pulling the toy car.

Sol:

We know that formula for work done when a body moves at an angle to the direction of force is:

\[ W = F \cos \theta \times s \]

\( s = 10 \text{ m} \), force = 5 N, \( \theta = 60° \)

Substituting the values in formula

\[ W = 5 \times \cos 60° \times 10 \]

\[ W = 5 \times 0.5 \times 10 = 25 \text{ J} \]

GROUP DISCUSSION: Teacher will ask the students to solve the following three numericals by using Numbered Head together cooperative strategy.

- Calculate the work done in lifting 200 Kg of water through a vertical height of 6 m. (assume \( g = 10 \text{m/s}^2 \))
- Calculate the work done when force of 1000N displaces an object through 45m, such that force makes an angle of 60° with the displacement.
250 Joules of work is done when a force of 50 N is applied on an object. Calculate the distance through which the object moves and also state its direction.

**ASSIGNMENT:** 1. A boy weighing 40 kg climbs up a tree of height 5m. Calculate the amount of work done (g=10m/s²)

**Day 5**

**EVALUATION:** Students will individually appear in formative test 15 for unit 15: Work, using STAD (Student Teams-Achievement Divisions) cooperative strategy

**DAY 6**

**UNIT 16: Kinetic Energy**

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Concept of energy
- Concept of Mechanical energy
- Kinetic Energy- Definition
- Derivation of formula for kinetic energy
- Relationship between Kinetic energy and momentum
- Numerical

**PREVIOUS KNOWLEDGE TESTING:** To stimulate the students of what they already know about the topic

Q1: What do you need to do work?
Q2: What do you mean by energy?
Q3: What are the different sources of energy?
Hybrid Instructional Package: Teaching- Learning Process

Following content will be presented through CD

Energy :

Energy of a body is defined as the capacity or the ability of the body to do work.

For doing a work, energy is always consumed. When a body is capable of doing more work, it is said to possess more energy and vice versa. Energy is a scalar quantity i.e. it has only magnitude and no direction. It's SI unit is Joule (J). Joule is a smaller unit of energy. The unit of energy called 'Joule' is named after a British physicist James Prescott Joule.

1 Joule energy is the energy required to do 1 Joule of work. The larger unit of energy is Kilojoule (KJ).

1KJ = 1000 J

Forms of Energy :

We have various forms of energy such as potential energy, kinetic energy, heat energy, chemical energy, electrical energy and light energy. But in this chapter we will discuss only kinetic energy and potential energy.

Kinetic energy : We see from our daily life examples, that the moving objects can do work. For example, a bullet can pierce a target, moving wind moves the blades of wind mill etc.

Hence we come to the conclusion that the objects in motion possess energy and this type of the energy is called kinetic energy. Kinetic energy is the energy possessed by a body due to its motion.

GROPU DISCUSSION: After the content presentation, students will be engaged in group discussion using Three Minute Review cooperative strategy,

Following content will be presented through traditional teaching

Mechanical Energy:

The sum of the potential energy and kinetic energy of a body is called its mechanical energy.

Expression for kinetic energy of a body

Let a body of mass ‘m’ starts to move with initial velocity ‘u’, acceleration ‘a’ and after covering a distance ‘S’ in time ‘t’, its velocity becomes ‘v’. Then from the third equation of motion we have;

\[ v^2 - u^2 = 2as \]

Or

\[ a = \frac{v^2 - u^2}{2s} \] ..........(1)

We know; Work done = Force x Displacement

\[ W = F x S \]

\[ W = m x a x S \] { ∴ Force = mass x acceleration }

\[ W = m x \left( \frac{v^2 - u^2}{2s} \right) x S \] ....... From equation (1)

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Hybrid Instructional Modules

\[ W = \frac{1}{2} m(v^2 - u^2) \]

If the body starts to move from rest then its initial velocity

i.e. \( u = 0 \)

or, \( W = \frac{1}{2} mv^2 \)

Now, the work is done by the body only when the Kinetic energy of the body has been used. So the work done on the body is equal to the kinetic energy possessed by the body.

\[ \therefore \text{Kinetic energy; } E_k = \frac{1}{2} mv^2 \]

**GROUP DISCUSSION:** Teacher will ask the students to discuss the following questions using Think Pair Share Cooperative Strategy

What will be the change in kinetic energy of a body?

1. If the speed of the body is halved.
2. If the speed of the body is doubled.
3. If the mass is doubled (keeping its velocity constant).
4. If the mass is reduced to half.

**ASSIGNMENT:** Derive an expression for the kinetic energy of a body of mass \( m \) moving with a velocity \( v \).

**DAY 7**

UNIT 16: Kinetic Energy

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Relationship between kinetic energy and momentum
- Numerical

**PREVIOUS KNOWLEDGE TESTING:** To stimulate the students of what they already know about the topic

Q1: What is mechanical energy?
Q2: What do you understand by kinetic energy of a body?
Q3: What is the formula for calculating kinetic energy possessed by body?
Q 4: What would have greater effect on the kinetic energy of an object: doubling the mass or
doubling the velocity?

**Hybrid Instructional Package: Teaching-Learning Process**

Following content will be presented through traditional teaching

**Relationship between Kinetic energy and momentum**

Momentum, \( p = \sqrt{2 \cdot m \cdot K.E} \)

Where \( m \) = mass of the body

\( K.E \) = Kinetic energy

**Numerical:** Calculate the kinetic energy of a body of mass 2 Kg moving with a velocity of 0.1 m/s

**Solution:** Here mass, \( m = 2 \) kg

Velocity, \( v = 0.1 \) m/s

We know that \( K.E = \frac{1}{2} m v^2 \)

\( = \frac{1}{2} \times 2 \times (0.1)^2 = 0.01 \) J

**GROUP DISCUSSION:** Teacher will ask the students to solve the following numerical by using **Numbered Head together** cooperative strategy.

- Calculate the kinetic energy of a body of mass 2 Kg moving with a speed of 20 m/s.
- A moving car of mass 1200 kg has 2.96 X 10^6 J of kinetic energy. Calculate its speed in km/h.

**Numerical:** Two bodies of equal masses move with uniform velocities \( v \) and \( 3v \) respectively. Find the ratio of their kinetic energies.

**Solution:** Let the mass of each body = \( m \)

1. Mass of first body = \( m \)

   Velocity of first body = \( v \)

   K.E of first body = \( \frac{1}{2} m v^2 \) ............(i)

2. Mass of second body = \( m \)

   Velocity of second body = \( 3v \)

   K.E of second body = \( \frac{1}{2} m (3v)^2 = 9/2 m v^2 \) ...........(ii)

   Ratio: By dividing equ (i) by (ii), we get

   K.E of first body = \( \frac{1}{2} m v^2 \) = 1/9

   K.E of second body = \( 9/2 m v^2 \)

   The ratio of K.E is 1:9
Numerical: Two bodies of masses 1g and 4g have equal momentum. What is the ratio of their Kinetic energies?

Solution: Case I: Mass of body, \( m_1 = 1g \)

Momentum, \( p = \sqrt{2} \cdot m.K.E = \sqrt{2} \cdot 1 \cdot K.E_1 \) \( ........(i) \)

Case II: Mass of body, \( m_2 = 4g \)

Momentum, \( p = \sqrt{2} \cdot m.K.E = \sqrt{2} \cdot 4 \cdot K.E_2 \) \( ........(ii) \)

Comparing (i) and (ii), we get

\[
\frac{\sqrt{2} \cdot K.E_1}{\sqrt{2} \cdot K.E_2} = \frac{\sqrt{8} \cdot K.E_2}{\sqrt{2} \cdot K.E_2} = 4:1
\]

GROUP DISCUSSION: Teacher will ask the students to solve the following numerical by using Numbered Head together- cooperative strategy.

✓ Calculate the momentum of a body of mass 10g and energy 80J.
✓ Two bodies of masses 10g and 50g have equal kinetic energy. What is the ratio of their momentum?

ASSIGNMENT: 1. Calculate the speed of a stone which possesses kinetic energy of 20J and mass of 100g.
2. Two bodies of equal masses move with uniform velocities \( v \) and \( 3v \) respectively. Find the ratio of their kinetic energies.

DAY 8

EVALUATION: Students will individually appear in formative test 16 for unit 16: Kinetic energy using STAD (Student Teams-Achievement Divisions) cooperative strategy

DAY 9

Teacher will take post-test of summative test VIII
Appendix A-3 (ix)
MODULE IX (PHYSICS)
WORK AND ENERGY

Content Sequence:

Unit 17: Potential Energy
- Potential Energy
- Gravitational Potential Energy
- Elastic Potential Energy
- Formula for Gravitational Potential Energy
- Factors on which Gravitational Potential Energy depends
- Gravitational Potential Energy is independent of path followed
- Numericals

Unit 18: Transformation of Energy and Power
- Concept of Transformation of Energy
- Conversion of Sun Energy into various different forms
- Conversion of one form of Energy into various different forms
- Law of Conservation of Energy
- Power
- Numericals

Enduring Understanding
An object can have energy not only by virtue of its motion, but also by virtue of its position and configuration. This energy is known as potential energy. The energy possessed by body by virtue of its position is called gravitational potential energy. For e.g. water stored in a dam or in an overhead tank possess potential energy due to their position. Energy possessed by a body by virtue of its configuration by extension or compression of the body is called elastic potential energy. Stretched / compressed spring. Body can have both potential energy as well as kinetic energy. For e.g. a flying bird, flying aero plane has both kinetic and potential energy. Energy is required for all the processes. Nothing would happen without energy. Things only happen when energy is converted from one form to another or we can say that when energy is transformed. For e.g. diesel or petrol contain chemical energy, nothing would happen if diesel or petrol remains in the fuel tank of vehicle. But when this chemical energy converts into heat energy in vehicle’s engine, movement of vehicle takes place. One thing to be noted is that when energy changes from one form to another, there is no loss or gain of energy i.e. total amount of
energy is constant. This is law of conservation of energy. Do all of us work at same rate? Answer is no. A stronger person may do certain work in relatively less time. The rate at which body can do work or utilize energy is called power.

**Behavioural Objectives of the module:** Listed in table 3.2 of Chapter 3

### DAY 1
Teacher will hold pre-test of summative test IX followed by brief introduction of the module IX

### DAY 2
**UNIT 17: Potential Energy**

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Concept of Potential Energy
- Gravitational Potential Energy
- Elastic Potential Energy
- Formula for Gravitational Energy

**PREVIOUS KNOWLEDGE TESTING:** To stimulate the students of what they already know about the topic

1. What do you mean by mechanical energy?
2. What is Kinetic energy?

**Hybrid Instructional Package: Teaching- Learning Process**

Following content will be presented through CD

**Potential Energy:** The energy possessed by body by virtue of its position or configuration is called potential energy.
For example, the heavy ball of a demolition machine is storing energy when it is held at an elevated position. This stored energy of position is referred to as potential energy. Similarly, a drawn bow is able to store energy as the result of its position.

The word ‘potential’ comes from Latin word which means ‘to be able’.

**Types of potential energy:**

1. Gravitational potential energy
2. Elastic potential energy

**Case I: Gravitational potential energy:**

Gravitational potential energy is the energy stored in an object as the result of its vertical position or height.

The energy is stored as the result of the gravitational attraction of the Earth for the object. For e.g. the massive ball of a demolition machine has gravitational potential energy. Some work has been done in lifting the ball of demolition machine to certain height against the force of gravity. This work gets stored up in the stone in the form of potential energy. And if we allow this massive ball to fall on roof top, it can do work to demolish the building.

**Case II: Elastic potential energy:**

Elastic potential energy is the energy stored in elastic materials as the result of their stretching or compressing.

Elastic potential energy can be stored in rubber bands, springs, an arrow drawn into a bow, etc. The change in shape of a body can be brought about by compressing, stretching, bending or twisting. Some work has to be done to change the shape of body temporarily. This work gets stored in the deformed body in the form of elastic potential energy. When this deformed body is released, it comes back to its original shape and size and potential energy is given out in some other form. In above figure bent bow has elastic potential energy stored in it due to change in its shape. This stored potential energy is used in form of kinetic energy in throwing off an arrow.

For e.g. Springs are a special instance of a device which can store elastic potential energy due to either compression or stretching. A force is required to compress a spring. In case of dart gun, the spring gets tightly compressed when dart in inserted in the gun.

The compressed springs of a dart gun store elastic potential energy. When the trigger is pulled, the springs apply a force to do work on the dart.
When the trigger is pulled, the spring is gradually released and it applies force to do work on the dart. The potential energy which is stored in the spring is converted into kinetic energy and is used in throwing off the dart.

The amount of elastic potential energy stored in such a device is related to the amount of stretch of the device - the more stretch, the more stored energy.

**Formula for Gravitational Potential Energy:**

Suppose a body of mass \( m \) is raised to a certain height \( h \) from the ground, then the work done on the body against gravity

\[
\text{WORK} = \text{FORCE} \times \text{DISPLACEMENT}
\]

When a body is lifted against gravity, a force is required to do so and the minimum force required to raise the body should be equal to its weight i.e.

\[
F = mg
\]

\[
\text{Work} = mg \times h
\]

This work gets stored up in the body as the potential energy, Thus

\[
\text{Potential energy} = m \times g \times h
\]

**Unit:** S.I. unit of potential energy is Joule.

**GROUP DISCUSSION:** After the content presentation, students will be engaged in group discussion using Three Minute Review cooperative strategy.

**GROUP DISCUSSION:** the following content will be discussed using Round Table or Rally Table Cooperative Strategy.

- Enlist four example each which possesses gravitational potential energy and elastic potential energy.

**ASSIGNMENT:** Differentiate between gravitational potential energy and elastic potential energy. Give two suitable example of each.

---

**DAY 3**

**UNIT 17: Potential Energy**

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Factors on which potential energy depends
- Numericals

xcvi
PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1. What kind of energy is possessed by the following?
   1) A stone kept on rooftop
   2) A running car
   3) A ceiling fan in off position
   4) A stretched spring lying on the ground
   5) Water stored in the reservoir of a dam

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through group discussion

Factors on which potential energy depends:

GROUP DISCUSSION: Teacher will ask the students to discuss the following question by using Numbered Head Together cooperative strategy.

Que 1: What will happen to the potential energy of a body when its
   (1) height is doubled
   (2) mass is doubled

Que 2: A person wants to reach sixth floor of the building. He can reach there by using three different paths (i) by using stairs (ii) by using ramp (iii) by using lift. In which case work done, in the form of gravitational potential energy will be maximum. Give reason in support of your answer.

GROUP DISCUSSION: Teacher will ask the students to discuss the following question by using Think Pair Share Cooperative Strategy

State whether the following objects possess kinetic energy, potential energy, or both:

1) A man climbing a hill
2) A flying aeroplane
3) A bird running on the ground
4) A flying bird

Following content will be presented through traditional teaching

Numerical: A body of mass 5 kg is raised to a height of 80 m. Calculate the potential energy possessed by the body (g = 9.8 m/s²)

Solution:

\[ \text{Mass, } m = 5 \text{ kg} \]
\[ \text{Height, } h = 80 \text{ m} \]
\[ g = 9.8 \text{ m/s}^2 \]
\[ P.E = m \times g \times h = 5 \times 9.8 \times 80 = 3920 \text{ J} \]
**GROUP DISCUSSION:** Teacher will ask the students to solve the following numericals by using Numbered Head together cooperative strategy.

- 58800 J of energy is required in lifting a mass of 50 kg. Find out the height to which the mass was lifted.
- Two bodies of masses 10 kg and 20 kg respectively are kept at the same height from the ground. Calculate the ratio of potential energy of A to that of B.

**ASSIGNMENT:**
1. If the potential energy of 480 J is utilized to lift a mass to a height of 4m above the ground, find the value of mass.
2. If 100 J and 500 J of energy are required to lift two bodies to same height respectively. Calculate the ratio of mass of body A to that of B.

**DAY 4**

**UNIT 17: Potential Energy**

**EVALUATION:** Students will individually appear in formative test 17 for unit 17: Potential energy using STAD (Student Teams-Achievement Divisions) cooperative strategy.

**DAY 5**

**UNIT 118: Transformation of energy and power**

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Concept of transformation of Energy
- Conversion of solar energy into different forms
- Conversion of one form of energy into another by human activities and gadgets

**PREVIOUS KNOWLEDGE TESTING:** To stimulate the students of what they already know about the topic

1. Which energy is present in stretched string of bow?
2. Which energy is possessed by arrow when it is released?
3. In above case which energy is converted into another form?
Hybrid Instructional Package: Teaching- Learning Process

Following content will be presented through traditional teaching:

In above case stretched string of bow has elastic potential energy stored in it due to change in its shape. This stored potential energy is used in form of kinetic energy in throwing off an arrow. Thus elastic potential energy is converted into kinetic energy.

Transformation of energy: The change of one form of energy into another form of energy is known as transformation of energy.

Conversion of solar energy into various forms:

Solar energy gets transformed into many others forms of energy which are useful to us - food energy, wind energy, fossil fuel energy, electrical energy.

GROUP DISCUSSION: For teaching above concept, teacher will engage the students in group discussion using Round Table or Rally Table Cooperative Strategy

What would have happened if nature had not allowed the transformation of energy? There is a view that life could not have been possible without transformation of energy. Do you agree with this?

Following content will be presented through CD:

Conversion of energy from one form to another form by human activities and gadgets we use:

<table>
<thead>
<tr>
<th>S. No</th>
<th>Transformation of energy</th>
<th>Devices Used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>From</td>
<td>To</td>
</tr>
<tr>
<td>1</td>
<td>Mechanical</td>
<td>Electrical Generator</td>
</tr>
<tr>
<td></td>
<td>Light</td>
<td>Match Box</td>
</tr>
<tr>
<td></td>
<td>Heat</td>
<td>Gas Lighter</td>
</tr>
<tr>
<td>2</td>
<td>Heat (Thermal)</td>
<td>Mechanical Steam Engine</td>
</tr>
<tr>
<td></td>
<td>Electrical</td>
<td>Solar Cells</td>
</tr>
<tr>
<td>3</td>
<td>Electrical</td>
<td>Mechanical Motors</td>
</tr>
<tr>
<td></td>
<td>Heat</td>
<td>Heater, immersion rod</td>
</tr>
<tr>
<td></td>
<td>Light</td>
<td>Tubes, Bulbs</td>
</tr>
<tr>
<td></td>
<td>Chemical</td>
<td>Charging Batteries</td>
</tr>
<tr>
<td></td>
<td>Sound</td>
<td>Loud Speaker</td>
</tr>
</tbody>
</table>
Hybrid Instructional Modules

<table>
<thead>
<tr>
<th></th>
<th>Chemical</th>
<th>Electrical</th>
<th>Batteries</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Atomic</td>
<td>Thermal (Heat)</td>
<td>Nuclear reactors</td>
</tr>
<tr>
<td>6</td>
<td>Magnetic</td>
<td>Kinetic</td>
<td>Cyclotron</td>
</tr>
<tr>
<td>7</td>
<td>Light</td>
<td>Electrical</td>
<td>Photocells</td>
</tr>
<tr>
<td>8</td>
<td>Sound</td>
<td>Electrical</td>
<td>Microphone</td>
</tr>
</tbody>
</table>

Energy conversions

1. **Hydel Power Station**:
   - P.E (stored water) → K.E (flowing water) → Rotational motion → Electrical energy
   - i.e. Mechanical Energy → Electrical Energy

2. **In Thermal power Station**:
   - Chemical Energy (coal) → Electrical Energy

3. **When nail is hammered into a plank**:
   - Kinetic Energy → Heat and Sound Energy

4. **In riding a bicycle**:
   - Muscular Energy → Mechanical Energy

5. **In dry cell**:
   - Chemical Energy → Electrical Energy

6. **In Television**:
   - Electrical Energy → Light and Sound Energy

7. **In Electric Heater**:
   - Electrical Energy → Heat Energy
8. When brakes are applied in any moving vehicle:

- Muscular Energy
- Heat, light and Sound

9. When hands are rubbed:

- Muscular Energy
- Heat Energy (due to friction)

10. (a) When an arrow is stretched in a bow:

- Muscular Energy
- Potential Energy

(b) On releasing the string of the bow

- Potential Energy
- Kinetic Energy

**GROPU DISCUSSION:** After the content presentation, students will be engaged in group discussion using Three Minute Review cooperative strategy.

**GROPU DISCUSSION:** Teacher will ask the students to answer the following question by using Think Pair Share Cooperative Strategy.

**Que 1:** Name the devices or machine which convert:

- 4) Mechanical energy into electrical energy
- 5) Chemical energy into electrical energy
- 6) Electrical energy into light energy

**Que 2:** Explain the transformation of energy in the following cases:

1) A ball is thrown upward
2) In riding a bicycle
3) When brakes are applied in any moving vehicle

**ASSIGNMENT:** Explain the energy changes in the following cases:

1) On releasing the string of the bow
2) Nail is hammered into a plank
3) When hands are rubbed

---

Hybrid Instructional Modules
DAY 6

UNIT 18: Transformation of energy and power

WARM UP: To establish rapport between teacher and student
List of objectives for the topic to help focus the learning:

- Law of conservation of energy
- Numerical

PREVIOUS KNOWLEDGE TESTING: To stimulate the students of what they already know about the topic

1) What is law of conservation of mass?
2) What do you mean by transformation of energy?
3) What is law of conservation of energy?

Hybrid Instructional Package: Teaching-Learning Process

Following content will be presented through CD:

Law of conservation of energy:

According to the law of conservation of energy “whenever energy changes, from one form to another, the total amount of energy remains constant.” In other words, when energy changes from one form to another, there is no loss or gain of energy. The total energy, before and after transformation remains the same.

Another definition of the law of conservation of energy is: Energy can neither be created nor destroyed.

To prove this principal, let us consider Kinetic Energy, potential energy and Total energy (T.E) of a body falling freely under gravity.

Suppose a ball of mass m, is kept at a point A, which is at a height h, above the ground.

At A, the potential energy is

\[ U_A = m \times g \times h \]

and K.E. = 0 \((\because v \text{ is zero as it is not moving})\)

\[ \therefore \text{Total Energy} = U_A + \text{K.E.} = mgh + 0 = mgh \]

The object is now allowed to fall freely under the influence of gravity. As the ball falls, its height h above the ground decreases and thus the potential energy also decreases. But as the ball falls, its
velocity \( v \) constantly increases and its K.E increases. As the ball falls more and more, its potential energy is gradually converted into an equal amount of kinetic energy. When the ball just reaches the ground, its potential energy becomes zero (because \( h \) becomes zero) and its kinetic energy becomes the maximum (because \( v \) becomes the maximum). At this stage, all the potential energy has been converted into kinetic energy. From this we conclude that the potential energy of ball has been changed into an equal amount of kinetic energy. However, the sum of potential energy and kinetic energy of the object would be the same at all points. There is no destruction of energy, and the total amount of energy remains constant.

i.e. \( P.E + K.E = \text{Constant} \)

\[ mgh + \frac{1}{2} mv^2 = \text{Constant} \]

The point will become clearer from the following data obtained in an experiment in which the potential energy (P.E.) and kinetic energy (K.E.) of a freely falling ball were calculated at different positions of its downward journey:

<table>
<thead>
<tr>
<th>Ball Position</th>
<th>P.E of Ball</th>
<th>K.E of Ball</th>
<th>Total Energy of Ball (P.E + K.E)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball at rest A</td>
<td>20 J</td>
<td>0 J</td>
<td>( 20 + 0 = 20 ) J</td>
</tr>
<tr>
<td>Falling Ball B</td>
<td>15 J</td>
<td>5 J</td>
<td>( 15 + 5 = 20 ) J</td>
</tr>
<tr>
<td>Falling Ball C</td>
<td>10 J</td>
<td>10 J</td>
<td>( 10 + 10 = 20 ) J</td>
</tr>
<tr>
<td>Falling Ball D</td>
<td>5 J</td>
<td>15 J</td>
<td>( 5 + 15 = 20 ) J</td>
</tr>
<tr>
<td>Just before hitting the Ball E</td>
<td>0 J</td>
<td>20 J</td>
<td>( 0 + 20 = 20 ) J</td>
</tr>
</tbody>
</table>

We can see from the data given in Figure 2 that:

- At position A, when the ball is at rest, it has 20 J of potential energy but zero kinetic energy. So, the total energy of the ball at position A is \( 20 + 0 = 20 \) J.
- At position B when the ball is falling, it has 15 J of potential energy and 5 J of kinetic energy. So, the total energy of the ball at position B is \( 15 + 5 = 20 \) J.
- At position C when the ball has fallen by half the distance, it has 10 J of potential energy and 10 J of kinetic energy. So, the total energy of the ball at position C is \( 10 + 10 = 20 \) J.
- At position D when the ball has fallen by more than half the distance, it has 5 J of potential energy and 15 J of kinetic energy. So, the total energy of the ball at position D is \( 5 + 15 = 20 \) J.
At position E when the ball is about to hit the ground, it has 0 J of potential energy and 20 J of kinetic energy. So, the total energy of the ball at position E is $0 + 20 = 20$ J.

From the above observations, it is clear that as the ball falls downwards, its potential energy goes on decreasing but its kinetic energy goes on increasing. The decrease in potential energy of the freely falling ball at any point in its path appears as an equal increase in its kinetic energy. So, the total energy (potential energy + kinetic energy) of the ball remains the same (20 joules) at every point during its free fall. Thus, the energy of a freely falling ball is conserved.

If, however, a ball is thrown upwards, then its kinetic energy goes on decreasing and its potential energy goes on increasing. The decrease in kinetic energy of the upward going ball at any point during its flight appears as an equal increase in its potential energy. But the total energy (kinetic energy + potential energy) of a ball thrown upwards remains constant at every stage of its flight. In this way, the energy of a ball thrown upwards is also conserved.

**GROUP DISCUSSION:** After the content presentation, students will be engaged in group discussion using Three Minute Review cooperative strategy.

**Following content will be presented through traditional teaching:**

**Numerical:** If an object of mass 10 kg is dropped from a height of 20 m, fill in the blanks in following table by computing the P.E and K.E in each case. Take the value of ‘g’ to be 10 m/s$^2$.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Height</th>
<th>P.E</th>
<th>K.E</th>
<th>T.E=P.E +K.E</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>15 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>10 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>5 m</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Just above the ground</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Sol:** Mass, $m = 10$ kg

Height from which it is dropped = 20 m

Initial velocity ‘$u$’ = 0 m/s$^2$

(A) When the object is dropped from height of 20 m

$P.E = m \times g \times h$

$= 10 \text{ kg} \times 10 \text{ m/s}^2 \times 20 \text{ m}$

$= 2000 \text{ J}$

$K.E = \frac{1}{2}mv^2$

$= \frac{1}{2} \times 10 \text{ kg} \times 0$

$= 0$

$T.E = P.E + K.E = 2000 \text{ J} + 0 = 2000 \text{ J}$
When the object is at height of 15 m from ground

\[ P.E = m \times g \times h \]
\[ = 10 \text{ kg} \times 10 \text{ m/s}^2 \times 15 \text{ m} \]
\[ = 1500 \text{ J} \]

\[ K.E = \frac{1}{2} m v^2 \]

From 3rd equation of motion
\[ V^2 - u^2 = 2as \]
\[ V - (0) = 2 \times 10 \times 5 \text{ m} \]
\[ = 100 \text{ m/s} \]
\[ \therefore K.E = \frac{1}{2} \times 10 \text{ kg} \times 100 \]
\[ = 500 \text{ J} \]

\[ T.E = P.E + K.E \]
\[ 1500 + 500 = 2000 \text{ J} \]

**GROUP DISSCUSSION:** Teacher will ask the students to solve part C of the above numerical by using **Numbered Head together** cooperative strategy.

Calculate the potential energy, kinetic energy and total energy when the object is at height of 10 m from the ground.

**ASSIGNMENT:** 1. Calculate the potential energy, kinetic energy and total energy of part D and E of the above numerical

   (2) When the object is at height of 5 m above the ground

   (3) When the object is just above the ground

**DAY 7**

**UNIT IX: Transformation of energy and power**

**WARM UP:** To establish rapport between teacher and student

List of objectives for the topic to help focus the learning:

- Concept of power
- Numericals

**PREVIOUS KNOWLEDGE TESTING:** To stimulate the students of what they already know about the topic

1) What is law of conservation of mass?
2) What do you mean by transformation of energy?
3) What is law of conservation of energy?
Hybrid Instructional Package: Teaching- Learning Process

Following content will be presented through CD:

**Power:** The rate of doing work or the rate of transfer of energy. If an agent does work $W$ in time $t$, then power is given by:

$$ \text{Power} = \text{work/time} $$

or $P = \frac{W}{t}$

Unit: watt

**Power in terms of energy** = Energy supplied/ time = $E/t$

**Power in terms of Force** = Work done/time = $W/t$

The power of agent indicates how fast it can do work. More the power of agent that does the work, lesser will be the time taken to do the given amount of work.

**Average power:** It is the total energy consumed by an agent divided by the total time taken, i.e.

$$ \text{Pav.} = \frac{E}{t} $$

Power is a scalar quantity being the ratio of two scalar quantities viz. energy and time.

**Commercial unit of energy:** kwh

1 kWh = $3.6 \times 10^6$ Joules

**GROUP DISCUSSION:** Teacher will ask the students to solve the following numerical by using *Think Pair Share* cooperative strategy

**Numerical:** An engine supplies 25000j of energy in one minute. Calculate the power of the engine in kilowatts.

**ASSIGNMENT:** An electric bulb of 60W is used for 6h per day. Calculate the units of energy consumed in one day by the bulb.

**DAY 8**

**EVALUATION:** Students will individually appear in formative test 18 for unit 18:
Transformation of energy using *STAD (Student Teams-Achievement Divisions)* cooperative strategy

**DAY 9**

Teacher will take posttest of summative test IX
Appendix A-2a

Entry Behaviour Test

Time: 30 min M. Marks: 70

Name: _____________________ Roll No.: 
Class: _____________________ Section: 
School: _____________________ Date: _____________

NOTE: (i) All the questions are compulsory. 
(ii) Marks allotted for each question is given against every question. 
(iii) Read the directions carefully.

Section A

Que 1: Fill in the blanks with one word only. (1 * 10=10 marks)
(1) Cytoplasm and nucleus are enclosed in membrane, called ________.
(2) Outer thick layer in cells of plant is called ________.
(3) Chromosomes are found in ________.
(4) Hydrogen and oxygen always combine in the ratio of 1:8 by mass to form _____.
(5) Solids have fixed shape and ________.
(6) All the matter is made up of tiny particles called ________.
(7) Force = ________ x acceleration
(8) Cell was discovered by ________.
(9) Largest cell is that of ________ egg.
(10) In multicellular organism, different necessary functions of the body are carried out by different ________.

Section B

Multiple Choice Questions

Que 2: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer.

1. State of matter that can be compressed easily is (1 * 9=9 marks)
   (a) Solid (b) liquid (c) Gas (d) Liquid and gas

2. Compound is made up of 
   (a) One element only
   (b) Two or more elements chemically combined together 
   (c) Two or more elements not chemically combined together
   (d) Two or more elements may or may not be bonded together

3. Which of the following metal can be beaten into thin sheets?
   (a) Aluminium (b) Phosphorus (c) Sulphur (d) Oxygen
4. The force by virtue of which earth attracts things or objects towards itself
   (a) Earth force
   (b) Gravitation force
   (c) Electrostatic force
   (d) Frictional force

5. Basic structural unit of living organism is
   (a) Organs
   (b) Cells
   (c) Tissues
   (d) Organ system

6. Projections coming out of amoeba cells are called
   (a) Pseudopodia
   (b) Cilia
   (c) Microvillia
   (d) All of those

7. Chlorophyll is stored in coloured bodies known as
   (a) Plastid
   (b) Mitochondria
   (c) Chromosomes
   (d) Nucleus

8. The smallest cell is present in
   (a) Human eye
   (b) Bacteria
   (c) Ostrich egg
   (d) Monkeys

9. Which of the following statement is correct regarding metals and non metals?
   (a) Metals are not ductile
   (b) All non metals are ductile
   (c) Generally, metal are ductile
   (d) Some non-metals are ductile

Section C
Que 3: State whether the following statements are true or false (1 * 5=5marks)
   (1) Element is made up of two different compounds ( )
   (2) Unicellular organisms have one celled body ( )
   (3) Organelles are present in the nucleus ( )
   (4) Solar cells convert solar energy into heat energy ( )
   (5) Chromosomes help in inheritance or transfer of character from the parents to the next generation ( )

Section D
Que 4: Complete the incomplete statement in one or two lines: (1 * 4=4marks)
   (1) Matter is defined as ________________________________
   (2) Malleability is defined as property of ________________________________
   (3) Force is defined as ________________________________
Section E

Que 5: Match the Column

(1) Match the substances given in column A with their uses given in column B

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gold</td>
<td>a. Thermometer</td>
</tr>
<tr>
<td>2. Iron</td>
<td>b. Electric Wires</td>
</tr>
<tr>
<td>3. Aluminium</td>
<td>c. Wrapping Food</td>
</tr>
<tr>
<td>4. Carbon</td>
<td>d. Jewellery</td>
</tr>
<tr>
<td>5. Copper</td>
<td>e. Machinery</td>
</tr>
</tbody>
</table>

(2) Identify and match types of fuel with examples, given in column B

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Solid Fuel</td>
<td>a. LPG</td>
</tr>
<tr>
<td>2. Liquid Fuel</td>
<td>b. Fuel oil</td>
</tr>
<tr>
<td>3. Gaseous Fuel</td>
<td>c. Charcoal</td>
</tr>
</tbody>
</table>

Section F

Que 6: Write the symbol of following compounds

2. Carbon ________ 5. Nitrogen ________
3. Calcium ________ 6. Iron ________

Que 7: Identify two organism having prokaryotic cells from given list

- Virus
- Bacteria
- Blue green algae
- Cheek cells
- Onion cells

(2 marks)

Que 8: Name the three states of matter. Give one example of each.

(6 marks)

Que 9: Distinguish between metals and non-metals on the basis of their properties given in the table.

<table>
<thead>
<tr>
<th>Properties</th>
<th>Metals</th>
<th>Non metals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hardness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heat Conduction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conduction of electricity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(4 marks)
Que 10: Give two examples of situations in which applied forces causes change in the shape of an object:
1. ____________
2. ____________ (2 mark)

Que 11: Give two examples of unicellular organisms: 1. ____________ 2. ____________.
(2 marks)

Que 12: Compare the plant cell and animal cells on the basis of point given in the table by writing present or absent against each part (6 marks)

<table>
<thead>
<tr>
<th>S. No</th>
<th>Part</th>
<th>Plant cell</th>
<th>Animal cell</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cell membrane</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>2</td>
<td>Cell wall</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>3</td>
<td>Nuclear membrane</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>4</td>
<td>Cytoplasm</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>5</td>
<td>Plastids</td>
<td>Present</td>
<td>Absent</td>
</tr>
<tr>
<td>6</td>
<td>Vacuole</td>
<td>Present</td>
<td>Absent</td>
</tr>
</tbody>
</table>

Que 13: Why should we increase the use of renewable sources of energy? (2 marks)

Que 14: Give three examples of renewable sources of energy:
1. ____________
2. ____________
3. ____________ (3 marks)
### Appendix A-2b

**Entry Behaviour Test**

**Difficulty Values and Discriminative Powers of Items**

<table>
<thead>
<tr>
<th>Item No</th>
<th>D. V.</th>
<th>D. P.</th>
<th>Remarks</th>
<th>Item No</th>
<th>D. V.</th>
<th>D. P.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q 1 (1)</td>
<td>0.38</td>
<td>0.25</td>
<td>Modified</td>
<td>Q 5: 1 (5)</td>
<td>0.70</td>
<td>0.58</td>
<td>Accepted</td>
</tr>
<tr>
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<tr>
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<td>0.58</td>
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<td>0.42</td>
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<tr>
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<td>0.42</td>
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<td>Q 2 (1)</td>
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<td>(6)</td>
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<td>Accepted</td>
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<td>0.25</td>
<td>Modified</td>
<td>(4)</td>
<td>0.63</td>
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<tr>
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<td>0.54</td>
<td>0.41</td>
<td>Accepted</td>
<td>Q 10 (1)</td>
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<td>0.75</td>
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<tr>
<td>Q 3 (1)</td>
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<td>Accepted</td>
<td>(2)</td>
<td>0.51</td>
<td>0.67</td>
<td>Accepted</td>
</tr>
<tr>
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<td>Q 11 (1)</td>
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<td>0.50</td>
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</tr>
<tr>
<td>(3)</td>
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<td>(2)</td>
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<tr>
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<td>(2)</td>
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<td>0.75</td>
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<tr>
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<td>Accepted</td>
<td>(5)</td>
<td>0.50</td>
<td>0.67</td>
<td>Accepted</td>
</tr>
<tr>
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<td>(6)</td>
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<td>0.75</td>
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<tr>
<td>Q 5: 1(1)</td>
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<td>Accepted</td>
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<td>(3)</td>
<td>0.56</td>
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</tbody>
</table>

\[ \text{cxi} \]
Appendix A-3a (i)

Formative Test 1 (Chemistry)

Time: 30 min M. Marks: 17

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the blanks by writing one word only (1 mark)
(i) In water, the proportion of hydrogen and oxygen is ______ by mass.

Que 2: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1 x2=2 marks)
(i) The Indian philosopher who suggested that matter is composed of very small particles called pramanu
   (a) John Dalton (b) Kanad
   (c) Thomson (d) Chadwick

(ii) The postulate of Dalton’s Atomic theory that explains the law of constant proportion is
   (a) Atom can neither be created nor be destroyed.
   (b) Elements consist of atoms having fixed mass and number and kind of atoms of each element in a given compound is fixed.
   (c) Atoms of different element have different masses.
   (d) Same element can combine in more than one ratio to form more than one compound.

Que 3: Complete the following statement in not more than two lines. (1x2=2 marks)
(i) Law of conservation of mass state that _______________________
(ii) Matter is defined as _______________________

Que 4: Name the scientist who gave: (1x2=2 marks)
a) Law of conservation of mass ______________
b) Law of constant proportion ______________

Que 5: If 100 grams of pure water were taken from different sources is decomposed by passing electricity, 11 grams of hydrogen and 89 grams of oxygen are always obtained. Which chemical law is illustrated by this statement? (1 marks)

Que 6: Which postulate of Dalton’s Atomic theory is the result of law of conservation of mass? (1 marks)

Que 7: Enlist two postulates of Dalton’s atomic theory. (2 marks)
Que 8: Illustrate with example the law of constant proportion. (2 marks)

Que 9: Copper sulphate reacts with sodium hydroxide to form a blue precipitate of copper hydroxide and sodium sulphate. In an experiment, 15.95 g of copper sulphate reacted with 8.0 g of sodium hydroxide to form 9.75 g of copper hydroxide and 14.2 g of sodium sulphate. Show that this data verifies the law of conservation of mass. (2 marks)

Que 10: Critically analyse the postulate of Dalton’s atomic theory which state that all the atoms of an element have exactly the same mass. (2 marks)
Appendix A-3a (ii)
Formative Test II (Chemistry)

Time: 30 min M. Marks: 20

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the blanks with one word only (1×3=3 marks)
(i) One nanometer = _______ meter.
(ii) Atomicity is the number of _______ present in one molecule of an element.
(iii) Anion is formed by _______ of electron.

Que 2: Complete the following statement in not more than two lines (1×3=3 marks)
(i) The atom is defined as ________.
(ii) Atomic mass of an element is defined as ________.
(iii) Atomic mass unit is equal to ________.

Que 3: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1×2=2 marks)
(i) Atomic radius is measured in
   (a) nm (b) mm (c) mm⁻¹ (d) mm⁻²
(ii) Modern symbol of element was proposed by
   (a) Dalton (b) Thomson (c) J.J Berzelius (d) Bohr

Que 4: Write the chemical symbol for the following elements: (1×2=2 marks)
(i) Magnesium (ii) Iron

Que 5: Write the atomicity of the following elements- (1×2=2 marks)
(i) Bromine (ii) Aluminum

Que 6: Calculate the molecular mass of sulphuric acid H₂SO₄ (Given: At. Masses, H = 1u, S = 32u, O = 16 u) (2 marks)

Que 7: Differentiate between molecule of an element and molecule of a compound. (2 marks)

Que 8: Calculate the formula mass of k₂CO₃ (Given: At. Masses, K=39u, C=12u, O=16 u) (2 marks)

Que 9: Why is cation positively charged? (2 marks)
Appendix A-3a (iii)
Formative Test III (Chemistry)

Time: 30 min  M. Marks: 20

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the Blanks with one word only  
(1×4=4 marks)
(i) Molecular compounds are formed by combination between two different ________ elements.
(ii) While writing the formula of molecular compounds the name of more electronegative
non-metal ends with suffix ________.
(iii) The formula for Sulphurdioxide is ________.
(iv) The formula for Ammonium sulphate is ________.

Que 2: Answer the following questions by choosing the best option from the given options. There
is only one right answer. Tick the right answer.  
(1×3=3 marks)
(i) While writing the formula of molecular compound (choose the two correct statements)
(a) Less electronegative non-metal element is written on left hand side.
(b) More electronegative non-metal element is written on left hand side.
(c) Less electronegative non-metal element is written on right hand side.
(d) More electronegative non-metal element is written on right hand side.

(ii) Ionic compounds are formed between
(a) Metal and Metal  (c) Non-metal and Non-metal
(b) Metal and non-metal  (d) Non-metal and Metal

(iii) The valency of Iron in FeCl₃
(a) 2+  (c) 3+
(b) 2-  (d) 3-

Que 3: What is meant by term chemical formula?  
(1 mark)

Que 4: Write the chemical formula for the following compounds:  
(2 marks)
(i) Calcium disulhide  
(ii) Hydrogen sulphide
(iii) Phosphorous pentoxide  
(iv) Carbon tetrachloride
Que 5: Write down the names of compounds represented by the following formulae:
(i) Al₂(SO₄)₃  (ii) CaCl₂  (iii) K₂SO₄  (iv) KNO₃  (4 marks)

Que 6: Match the following

<table>
<thead>
<tr>
<th>Elements</th>
<th>Valency</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Sodium</td>
<td>(a) 1 and 2</td>
</tr>
<tr>
<td>(ii) Copper</td>
<td>(b) 3</td>
</tr>
<tr>
<td>(iii) Phosphorus</td>
<td>(c) 4</td>
</tr>
<tr>
<td>(iv) Iron</td>
<td>(d) 2</td>
</tr>
<tr>
<td>(v) Carbon</td>
<td>(e) 1</td>
</tr>
<tr>
<td>(vi) Sulphur</td>
<td>(f) 2 and 3</td>
</tr>
</tbody>
</table>

(3 marks)

Que 7: Write the valency and symbols for the following ion:  (2 marks)

(i) Ferrous Ion______  (iii) Bicarbonate Ion______
(ii) Sulphide Ion______  (iv) Phosphate Ion____

Que 8: The valency of element Z is 3. Write the formula of its oxide.  (1 mark)
Appendix A-3a (iv)

Formative Test IV (Chemistry)

Time: 30 min  M. Marks: 20

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the blanks  
(i) Unit of molar mass is _________.  
(ii) The value of Avogadro number is _________.  
(iii) Number of atoms present in 12 g of carbon-12 element is _________.  

Que 2: State whether the following statements are True or False  
(i) One gram molecular mass of a substance has 6.022 x 10\(^{23}\) molecules.  
(ii) 32 g of oxygen molecule has 12.044 x 10\(^{23}\) molecules.  

Que 3: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer.  
(i) The molar mass of Sulphur molecule, S\(_8\) (At. Mass, S=32 u)  
   (a) 256 g/mol  
   (b) 256 g  
   (c) 254 g/mol  
   (d) 254 g  
(ii) Gram atomic mass of a substance  
   (a) is equal to atomic mass expressed in grams  
   (b) represent mass of one mole  
   (c) contains 6.022 x 10\(^{23}\) atoms  
   (d) all of these  
(iii) The mass of 0.2 moles of oxygen atoms is  
   (a) 3.2 g  
   (b) 3.0 g  
   (c) 4.2 g  
   (d) 4.0 g  

Que 4: Complete the incomplete statement  
(i) The molar mass of a substance is ______________________.  
(ii) The mole represents (i) ______________________.  
    (ii)_______________________________.  

Que 5: Define Mole.  

Que 6: How many moles are there in 34.5 g of sodium? (At. Mass Na= 23 u)  

Que 7: If 16 g of oxygen contains 1 mole of oxygen atoms, calculate the mass of one atom of oxygen.  

Que 8: Calculate the number of molecules of sulphur (S\(_8\)) present in 16 g of solid sulphur.  

(3 marks)
Appendix A-3a (v)
Formative Test V (Chemistry)
Time: 30 min M. Marks: 25
NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.
Que 1: Fill in the Blanks with one word only (1 x 4 = 4 marks)
(i) The electron is present in ________ while neutron and proton is present in ________.
(ii) The mass of proton in grams is equal to ________.
(iii) The subatomic particle not present in a hydrogen atom is ________.
(iv) Almost all the mass of an atom is concentrated in a small region of space called the ________.
Que 2: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1 x 5 = 5 marks)
(i) The neutron makes the nucleus stable because
   (a) It stabilize the positive charge of proton and negative charge of electron
   (b) It dilutes the repulsive forces between positively charged nucleus.
   (c) Neutron is formed by an electron and proton combining together.
   (d) All of these.
(ii) The Thomson’s model of the atom did not discuss about
   (a) Electron  (b) Proton  (c) Neutron  (d) none of these
(iii) Rutherford’s alpha-particle scattering experiment leads to the discovery of
   (a) Nucleus  (b) Neutron  (c) Proton  (d) Electron
(iv) When α-particles are sent through a thin metal foil, most of them go straight through the foil because
   (a) α-particles move with the high velocity
   (b) α-particles are positively charged
   (c) Most part of the atom is empty space
   (d) α-particles are lighter than electron
(v) α-particles carries
   (a) a charge of +2 and a mass of 2 units
   (b) a charge of +2 and a mass of 4 units
   (c) a charge of +4 and a mass of 2 units
   (d) no charge and no mass

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Que 3: Complete the incomplete sentences in one or two lines. (1×2=2 marks)
(i) Electron is defined as the particles_________________.
(ii) The major limitation of Rutherford’s model of atom is_________________.

Que 4: List the sub-atomic particles of an atom. (3 marks)

Que 5: Describe Thomson’s model of the atom. (2 marks)

Que 6: State various postulates of Rutherford’s model of an atom. (3 marks)

Que 7: Compare the properties of electron, proton and neutron. (6 marks)
Appendix A-3a (vi)
Formative Test VI (Chemistry)
Time: 30 min M. Marks: 27

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the following Blanks: (1 × 4=4 marks)
(i) Bohr used _____, _____, _____, _____, _____ letters to represent electron shells in an atom.
(ii) Nucleus is positively charged due to presence of ________.
(iii) The shell nearest to nucleus has _________ energy where as the shell farthest from the nucleus has _________ energy.
(iv) The total number of protons and neutrons in the nucleus of an atom is called its __________.

Que 2: An atom of element is represented as $^9_4X$, where (2 marks)
(i) superscript ‘9’ denotes ______
(ii) subscript ‘4’ denotes ______.

Que 3: State whether following statements are True or False (1 × 2=2 marks)
(i) Thomson proposed that the nucleus of an atom contains proton and neutron.
(ii) Electron gains energy when it jumps from lower energy level to higher level.

Que 4: Define atomic number. (2 marks)

Que 5: Why is atom neutral inspite of the presence of charged particles in it? (2 marks)

Que 6: How did Neil Bohr explain the stability of atom? (2 marks)

Que 7: Explain why, atomic number of element is equal to electrons in neutral state and not in ionic state. (2 marks)

Que 8: Explain why, the atomic number of an element does not change during chemical reaction. (2 marks)

Que 9: Describe Bohr’s model of the atom. (3 marks)

Que 10: What is mass number? Give its relationship with atomic number (3 marks)

Que 11: Complete the following table:- (3 marks)

<table>
<thead>
<tr>
<th>Atomic No.</th>
<th>Mass No.</th>
<th>No. of protons</th>
<th>No. of neutrons</th>
<th>No. of electrons</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
Appendix A-3a (vii)
Formative Test VII (Chemistry)

Time: 30 min. M. Marks: 23

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1×5=5 marks)

(i) Arrangement of electrons in an atom is given by
   (a) Neil Bohr  (b) Bury  (c) Bohr and Bury  (d) None of these

(ii) The correct electronic configuration of Sodium is
   (a) 2,8,1  (b) 2,8,2  (c) 8,2,1  (d) 2,8,0

(iii) The noble gases are inert because
   (a) they have completely filled outermost shell
   (b) they do not react with other element
   (c) they have 8 electrons in the outermost shell
   (d) all of these

(iv) An atom can acquire inert gas configuration by
   (a) losing one or more electrons  (b) gaining one or more electrons
   (c) sharing one or more electrons  (d) all of these

(v) The valency of an element is equal to
   (a) number of valence e’s in its atom
   (b) number of e’s required to complete octet in outermost shell
   (c) 8 minus the no. of valence e’s in its atom
   (d) all of these

Que 2: Fill in the Blanks: (1 mark)

(i) The elements having 8 electrons in the valence shell are known as __________.

Que 3: Complete the incomplete sentences: (1×2=2 mark)

(i) Electronic configuration of the element is_____________________

   cxii
Valence electrons are defined as those electrons that take part in ________.

Que 4: State whether the following statements are True or False: (1×2=2 marks)
(i) The valency of metal is equal to 8 minus the number of valence electrons in its atom.
(ii) The outermost shell of an atom can accommodate more than 8 electrons.

Que 5: Complete the following table: (2 marks)

<table>
<thead>
<tr>
<th>Shell</th>
<th>Maximum number of Electrons</th>
<th>Shell</th>
<th>Maximum number of Electrons</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>_______</td>
<td>_____</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>M</td>
<td>_______</td>
</tr>
</tbody>
</table>

Que 6: Draw atomic diagram of element having atomic number 9. (2 marks)

Que 7: Complete the following table: (9 marks)

<table>
<thead>
<tr>
<th>Atomic No.</th>
<th>Electronic Configuration</th>
<th>Valence Electrons</th>
<th>Valency</th>
</tr>
</thead>
<tbody>
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<td>13</td>
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<td>17</td>
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</tr>
</tbody>
</table>
Appendix A-3a (viii)
Formative Test VIII (Chemistry)

Time: 30 min  M. Marks: 18

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: State whether the following statement is True or False: (1 mark)
(i) Isotopes have identical physical properties due to presence of different number of neutrons.

Que 2: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1 mark)
(i) Isobars of an element have
   (a) same atomic number but different mass number.
   (b) same atomic number but different number of neutrons.
   (c) different atomic number but same mass number.
   (d) different atomic number but same number of protons.

Que 3: Complete the incomplete statements: (2 marks)
(i) Isotopes have different atomic masses due to __________________________.

Que 4: What are Isotopes? Explain by giving examples. (2 marks)

Que 5: Write the Isotopes of oxygen? (2 marks)

Que 6: Explain why Isotopes of an element have identical chemical properties? (2 marks)

Que 7: Bromine occurs in the nature mainly in the form of two Isotopes $^{35}\text{Br}$ and $^{37}\text{Br}$ with relative abundance 49.7% and 50.3% respectively. Calculate the average atomic mass of Bromine atom. (2 marks)

Que 8: An element Z contains two naturally occurring Isotopes $^{17}Z$ and $^{19}Z$. If the average atomic mass of this element be 35.5 u, calculate the percentage of two isotopes. (2 marks)

Que 9: Which of the following atomic species are Isotopes and which are Isobars? (2 marks)
$^{26}\text{A}$, $^{28}\text{B}$, $^{35}\text{X}$, $^{35}\text{Y}$

Que 10: Match the following: (2 marks)
Radioisotopes  Application
(i) U-235  (a) activity of thyroid gland
(ii) Arsenic-74  (b) Fuel in the reactor
Appendix A-3a (ix)

Formative Test IX (Biology)

Time: 40 min  Max. Marks: 35

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the blanks: (5 marks)
(i) The size of cell is measured in ______.
(ii) The plasma membrane is made up of ______ and ______.
(iii) The nuclear region of prokaryotic cell containing only nucleic acid is called ______.
(iv) In diffusion substances move from a region of ______ concentration to ______ concentration.
(v) Amoeba engulfs its food by the process of ______.

Que 2: Give one word for the following: (2 marks)
(i) An organism whose body consists of many cells ______.
(ii) An organism in which single cell constitute the whole organism ______.

Que 3: Match the name of scientist in column A with their discoveries in column B (3 marks)

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Robert Hooke</td>
<td>a) Cell theory</td>
</tr>
<tr>
<td>2. Robert Brown</td>
<td>b) Nucleus</td>
</tr>
<tr>
<td>3. Schleiden and Schwann</td>
<td>c) Cell</td>
</tr>
</tbody>
</table>

Que 4: State whether the following statements are True or False: (3 marks)
(i) The shape and size of cells are related to the function they perform. ( )
(ii) Plant cell is bounded by a cell wall composed of cellulose. ( )
(iii) If dried raisins are put into pure water, water will come out of the raisins ( )

Que 5: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (5 marks)
(i) Organism lacking nucleus and membrane bound organelle are
   (a) Diploids  (b) Prokaryotes  (c) Haploids  (d) Eukaryotes
(ii) The longest cell present in the human body is
   (a) Nerve cell  (b) Muscle cell
(c) Liver Cell  (d) Kidney Cell

(iii) The outermost covering of cell is known as
(a) Cell wall  (b) Nuclear membrane
(c) Tonoplast  (d) Plasma membrane

(iv) The shrinkage or contraction of contents of cell away from cell wall due to loss of water is called
(a) Plasmolysis  (b) Endocytosis
(c) Osmosis  (d) Diffusion

(v) The function of storing and transmitting the hereditary information from one generation to another is performed by
(a) Plastids  (b) Golgi bodies
(c) Centromere  (d) Chromosome

Que 6: Write two main differences between prokaryotic and eukaryotic cell. (2 marks)

Que 7: Why is cell called structural and functional unit of life. (2 marks)

Que 8: Write one major difference between cell membrane and cell wall. (2 marks)

Que 9: Why cell membrane is called a selectively permeable membrane? (2 marks)

Que 10: Define osmosis in your words. (1 marks)

Que 11: Write down the 4 major components of nucleus. (2 marks)

Que 12: Differentiate between chromatin and chromosome. (2 marks)

Que 13: What is the main function of each of the following? (2 marks)
   (i) Nuclear membrane
   (ii) Nucleolus

Que 14: Differentiate between diffusion and osmosis. (2 marks)
Appendix A-3a (x)
Formative Test X (Biology)

Time: 40 min. Max. Marks: 30

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the blanks: (4 marks)
(i) Cytoplasm and nucleus together constitute ________.
(ii) The cytoplasm contains a number of structures called cell ________.
(iii) Endoplasmic reticulum has flattened sacs known as ________.
(iv) The membrane surrounding the vacuole of a plant cell is called ________.

Que 2: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (4 marks)
(i) Identify the cell organelle whose main function is cell secretion
   (a) Plastids (b) Endoplasmic reticulum (c) Golgi apparatus (d) Nucleolus
(ii) Cell organelle found only in plants is
   (a) Golgi apparatus (b) Mitochondria (c) Plastids (d) Ribosomes
(iii) The radiant energy of sunlight is converted to chemical energy and stored as
   (a) AMP (b) ADP (c) ATP (d) APP
(iv) The cell organelle that can synthesize their own proteins
   (a) Mitochondria (b) Lysosome (c) Plastids (d) both (a) and (c)

Que 3: Match the cell organelle given in column A with their functions in column B (4 marks)

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mitochondria</td>
<td>a) Turgidity</td>
</tr>
<tr>
<td>2. Golgi bodies</td>
<td>b) Protein synthesis</td>
</tr>
<tr>
<td>3. Vacuole</td>
<td>c) Lysosome formation</td>
</tr>
<tr>
<td>4. Endoplasmic Reticulum</td>
<td>d) Energy</td>
</tr>
</tbody>
</table>

cxxvi
Que 4: Name any three cell organelles of eukaryotic cell. (3 marks)

Que 5: Distinguishing between cytoplasm and nucleoplasm. (2 marks)

Que 6: Enlist four functions of Golgi apparatus. (4 marks)

Que 7: Why are lysosomes known as suicidal bags? (2 marks)

Que 8: What will happen to the life of a cell if there was no Golgi apparatus? (2 marks)

Que 9: Enlist different functions of following:

(i) SER
(ii) RER
(iii) Leucoplast
(iv) Chromoplast
(v) Chloroplast (5 marks)
Appendix A-3a (xi)
Formative Test XI (Biology)

Time: 30 min  Max. Marks: 30

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the blank (2 marks)
(i) The apical meristem occurs at ____________.
(ii) Lateral meristem is present at the ____________ of the stem

Que 2: State whether following statements are True or False (1 x 3 = 3 marks)
(i) In monocot stems, intercalary meristem is located at the base of internodes.
(ii) Intercalary meristem helps in increasing the diameter of the root and stem in plants.
(iii) Chlorophyll is present in chlorenchyma tissues.

Que 3: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1 x 2 = 2 mark)
(i) Which of the following tissue contains isodiametric cells
   (a) Parenchyma  (b) Collenchyma
   (c) Sclerenchyma  (d) All the above
(ii) The tissue which gives buoyancy to the aquatic plants is
   (a) Chlorenchyma  (b) Aerenchyma
   (c) Parenchyma  (d) Sclerenchyma

Que 4: Name the tissue found in the following: (1 x 3 = 3 marks)
(i) At the growing tips of root, stem and leaves
(ii) In the hard coverings of seeds and nuts
(iii) In the veins of leaves

Que 5: Match tissues given in column ‘A’ with the function they perform given in column ‘B’ (1 x 3 = 3 marks)

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Collenchyma</td>
<td>(a) Losely packed with inter-cellular space</td>
</tr>
<tr>
<td>(ii) Parenchyma</td>
<td>(b) Walls are thickened due to lignin.</td>
</tr>
</tbody>
</table>

CXXVIII
(iii) Sclerenchyma (c) Flexibility in plants.

Que 6: Define ‘differentiation’ in your own words.  

(1 mark)

Que 7: Define tissue.  

(1 mark)

Que 8: Arrange the following terms in correct sequence of development:  

Tissue, Organs, Tissue System, Cell, Organism, Organ System  

(1 mark)

Que 9: Draw a flow chart showing different types of plant tissue.  

(7 marks)

Que 10: Differentiate between parenchyma, collenchymas and sclerenchyma on the basis of their cell wall and intercellular spaces present.  

(3 marks)

Que 11: What is the function of lateral meristem?  

(1 mark)

Que 12: How is meristematic tissue different from permanent tissue?  

(3 marks)
Appendix A-3a (xii)
Formative Test XII (Biology)

Time: 30 min Max. Marks: 25

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Complete the following sentence:
1. How are simple tissues different from complex tissue? (2 marks)
   (i) Simple tissue is composed of ______________________
   (ii) Complex tissue is composed of ______________________

Que 2: Fill in the blanks (2 marks)
   (i) In higher plants food is conducted by _________.
   (ii) The main function of xylem parenchyma is _________.

Que 3: State whether the following statement is True or false (2 marks)
   (i) Cuticle is made up of a fatty substance, called cutin. ( )
   (ii) Phloem sclerenchyma consists of living cells. ( )

Que 4: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (2 marks)
   (i) Which of the following tissue is composed of mainly dead cells?
      (a) Phloem    (b) Epidermis
      (c) Xylem    (d) Endodermis
   (ii) Complex tissue consists of
      (a) Different types of cells carrying out the same functions.
      (b) Different types of cells carrying out different functions.
      (c) Same type of cells having the same origin and carry the same function.
      (d) Different types of cells having the same origin and carry the same function.

Que 5: Define vascular bundle. (1 marks)

xxx
<table>
<thead>
<tr>
<th>Question</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Que 6:</td>
<td>What is the function of xylem in plant? (1 marks)</td>
</tr>
<tr>
<td>Que 7:</td>
<td>Differentiate between tracheid and vessel. (2 marks)</td>
</tr>
<tr>
<td>Que 8:</td>
<td>Enlist different components of xylem? (2 marks)</td>
</tr>
<tr>
<td>Que 9:</td>
<td>Discuss functions of various component of phloem by drawing well labeled diagram of phloem. (4 marks)</td>
</tr>
<tr>
<td>Que 10:</td>
<td>Why does cork act as a protective tissue. (1 marks)</td>
</tr>
<tr>
<td>Que 11:</td>
<td>What is the function of epidermis in plants? (1 marks)</td>
</tr>
<tr>
<td>Que 12:</td>
<td>Write the role of given epidermal modification: (3 marks)</td>
</tr>
<tr>
<td></td>
<td>(i) Waxy coating of the leaves of aquatic plant.</td>
</tr>
<tr>
<td></td>
<td>(ii) Long hair like parts on the epidermal cells of roots.</td>
</tr>
<tr>
<td></td>
<td>(iii) Lenticels/stomata.</td>
</tr>
<tr>
<td>Que 13:</td>
<td>Differentiate between xylem and phloem. (2 marks)</td>
</tr>
</tbody>
</table>
Appendix A-3a (xiii)
Formative Test XIII (Biology)

Time: 30 min  Max. Marks: 30

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (5 marks)

(i) Simple epithelium is a tissue in which cells are
(a) Hardened and provide support to organs.
(b) Continuously dividing to form an organ.
(c) Cemented directly to one another to form a single layer.
(d) Loosely connected to one another to form an irregular layer.

(ii) Pavement epithelium is also known as
(a) Squamous epithelium (b) Cuboidal epithelium
(c) Ciliated epithelium (d) Columnar epithelium

(iii) Ciliated epithelium is found in
(a) Tongue (b) Oesophagus
(c) Trachea (d) Uterus

(iv) Brush bordered epithelium is found in
(a) Stomach (b) Small intestine
(c) Fallopian tube (d) Trachea

(v) Which of the following is voluntary muscle?
(a) Striated muscles (b) Non-striated muscle
(c) Cardiac muscle (d) none of these

Que 2: Name the place in living organisms where following tissues are located:

(i) Squamous epithelium
(ii) Stratified squamous epithelium
(iii) Cuboidal epithelium

Que 3: Define epithelial tissue. (1 marks)
Que 4: Define muscle issue. (1 marks)

Que 5: What is the main function of sensory epithelium? (1 marks)

Que 6: Enlist four main types of animal tissue. (2 marks)

Que 7: Draw diagram of squamous epithelium. (2 marks)

Que 8: Describe three main functions of epithelial tissue. (3 marks)

Que 9: Diagrammatically show the difference between the three types of muscle fibers. (3 marks)

Que 10: Name the place in living organisms where the following tissues are located:
   (i) Skeletal muscles ____________.
   (ii) Smooth muscle ____________.
   (iii) Cardiac muscle ____________. (3 marks)

Que 11: Enlist six different types of epithelial tissues. (6 marks)
Appendix A-3a (xiv)

Formative Test XIV (Biology)

Time: 30 min Max. Marks: 25

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the blanks (3 marks)
(i) Cartilage consists of _______ cells.
(ii) Fats are stored in animal in _______ tissue.
(iii) Synapse is a loose connection between _____ and _____ of nerve cell.

Que 2: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (4 marks)
(i) The end of a long bone is connected to another bone by
   (a) Ligament  (b) Tendon  (c) Cartilage  (d) Muscle

(ii) Tendon is a structure which connects
   (a) Bone with a bone  (b) Muscle with a bone  
   (c) Nerve with a muscle  (d) Muscle with a muscle

(iii) Ligaments and tendons are formed of
   (a) Epithelial tissue  (b) Muscular tissue  
   (c) Cartilage  (d) Connective tissue

(iv) Fluid part of blood after removal of corpuscles is
   (a) Plasma  (b) Lymph  (c) Serum  (d) Vaccine

Que 3: Match the tissues given in Column A with their functions given in Column B (3 marks)

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) Connective tissue</td>
<td>a)</td>
</tr>
<tr>
<td>(ii) Blood tissue</td>
<td>b)</td>
</tr>
<tr>
<td>(iii) Nervous tissue</td>
<td>c)</td>
</tr>
</tbody>
</table>

Transport  Message  Strength
Que 4: Name the places in living organism where the following tissues are located:
   (i) Areolar connective tissue ________________ . (3 marks)
   (ii) Adipose tissue ________________ .
   (iii) Nervous tissue ________________ .

Que 5: Why blood is considered as connective tissue. (1 marks)

Que 6: Write one important function of nerve cells. (1 marks)

Que 7: Draw well labeled diagram of neuron. (2 marks)

Que 8: Distinguish between the following in one-two sentences for each: (8 marks)
   (i) RBCs and WBCs
   (ii) Bone and cartilage
   (iii) Blood & lymph
   (iv) Tendon and ligament
Appendix A-3a (xv)

Formative Test XV (Physics)

Time: 40 min M. Marks 31

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the blanks in one word only (3 marks)
(i) Work done is positive when the angle between displacement and direction of force is ______.
(ii) Work is a ________ Physical Quantity.
(iii) S.I. unit of work is ________.

Que 2: Write T for the True statements and F for false statement (4 marks)
(i) Work done in case of satellite moving around the earth is zero. ( )
(ii) Work done by the brakes applied to a moving car is always positive. ( )
(iii) Work done when the object falls freely under the influence of gravity is positive. ( )
(iv) When the body is lifted, the work done by the gravitational force is negative. ( )

Que 3: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1×3=3 marks)

(i) Mechanical work includes
(a) Climbing up the steps of staircase
(b) Pushing a huge rock
(c) Lifting weight from the ground level to a certain height
(d) Child preparing for the exams

Choose the correct answer
(1) a & b (2) a & c (3) b & c (4) a & d

(ii) Work is done when
(a) A girl pulls a chair
(b) A donkey is carrying a load on its back
(c) An artificial satellite moving around the earth
(d) all of these
(iii) Work done will be greater if
(a) force is increased          (b) force is decreased
(c) distance is increased      (d) distance is decreased
Select the correct option
(1) a & d   (2) a & b   (3) a & c   (4) c & b

Que 4: Complete the incomplete statement in not more than two lines (2 marks)
(i) The two conditions needed to be satisfied for the work to be done are
(a)__________________________________________________________________________.
(b)__________________________________________________________________________.

Que 5: Define work (1 mark)

Que 6: A person holds a bundle of hay over his head for 30 min. and gets tired. Has he done some work or not? Justify your answer. (2 marks)

Que 7: Write an expression for the work done by a constant force. (2x8=16 marks)

Que 8: What is unit of work in CGS system and what is its relationship with Joule?

Que 9: Write the formula for the work done on a body when it moves at an angle of $\theta$ to the direction of the force applied. State the meaning of each symbol used.

Que 10: Find the work done, when a force of 20N displaces a body through 8m. in the direction of applied force.

Que 11: If 200J of work was done when a force of 12N acts, what was the distance moved by the force?

Que 12: A boy weighing 40kg climbs up a tree of height 5m. Calculate the amount of work done?
\[ g = 9.8 \text{m/s}^2 \]

Que 13: Calculate the work done, if a force of 1000 N causes a displacement of 45 m, such that force makes an angle of 60$^\circ$ with the displacement.

Que 14: Write the formula for the work done against gravity. State the meaning of each symbol used.
Appendix A-3a (xvi)
Formative Test XVI (Physics)

Time: 30 min  M. Marks 22

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the blanks (1 x 4 = 4 marks)
(i) Energy is a ________ (scalar/vector) quantity.
(ii) S.I. unit of energy is ________.
(iii) Mechanical energy is sum of ________ and ________.
(iv) S.I. unit of kinetic energy is ________.

Que 2: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1 x 5 = 5 marks)
(i) When the speed of moving object is doubled, its
(a) Acceleration is doubled (b) Weight is doubled
(c) Kinetic energy is doubled (d) Kinetic energy increases four times

(ii) When the mass of body is reduced to half, its kinetic energy is
(a) doubled (b) halved (c) increases four times (d) remains same

(iii) If the speed of car is increased 4 times, the kinetic energy of the car increases
(a) 4 times (b) 16 times (c) 8 times (d) 20 times

(iv) Two bodies of masses 10g and 50g have equal kinetic energy. What is the ration of their momentum?
(a) 1:4 (b) 1:2 (c) 1:8 (d) 1:16

(v) A 1kg mass has a kinetic energy of 1 Joule when its speed is
(a) 0.45 m/s (b) 1 m/s (c) 1.4 m/s (d) 4.4 m/s

Que 3: What is energy? (1 mark)

Que 4: Define S.I unit of energy. (1 mark)

Que 5: Define mechanical energy. (1 mark)

Que 6: Write the relation between kinetic energy and momentum. (1 mark)

Que 7: Define kinetic energy. Give its example. (2 x 3 = 6 marks)

Que 8: Which would have greater effect on the kinetic energy of an object, doubling the mass or doubling the velocity?

Que 9: Find out the kinetic energy of a body of mass 2 kg moving with a speed of 20 m/s.
Que 10: Derive expression for the kinetic energy of a body which starts from rest and acquires a velocity under the action of constant force. (3 marks)

Appendix A-3a (xvii)
Formative Test XVII (Physics)

Time: 40 min M. Marks: 26

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the blanks
(i) Gravitational potential energy of a body is by virtue of its

Que 2: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1x5=5 marks)
(i) Which one of the following does not possess elastic potential energy.
(a) Compressed string (b) Compressed gas in the cylinder (c) Water started in a dam (d) Stretched bow and arrow
(ii) When the height of the object is double, its
(a) K.E is double (b) Potential energy is double (c) Acceleration is double (d) Potential energy is reduced to half
(iii) An object of mass 1 Kg has potential energy of 1 Joule relative to the ground, when it is at the height of: (Choose the right answer)
(a) 0.102m (b) 1m (c) 9.8m (d) 32m
(iv) Two bodies of masses 10Kg and 20Kg respectively are kept at the same height from the ground. The ratio of potential energy of A to that of B is
(a) 1:1 (b) 1:2 (c) 2:1 (d) None
(v) A flying aero plane possesses
(a) Potential energy (b) Kinetic energy (c) Potential energy as well as Kinetic energy (d) No relationship with energy

Que 3: Define potential energy. (1 marks)

Que 4: Define elastic potential energy. (1 marks)

Que 5: What is difference between Potential energy and Kinetic energy? (2 marks)

Que 6: Derive an expression for the potential energy of a body, when it is lifted against the gravity. (2 marks)
Que 7: Give two examples where potential energy is stored due to its position. (2 marks)

Que 8: Give two examples where potential energy is stored due to its configuration or shape. (2 marks)

Que 9: Show with the help of example that gravitational potential energy is independent of the path followed. (2 marks)

Que 10: Find the energy possessed by an object of mass 10 Kg when it is at the height of 6m above the ground. Given \( g = 9.8 \text{ m/s}^2 \) (2 marks)

Que 11: If acceleration due to gravity is 10 m/s\(^2\) what will be the potential energy of a body of mass 1 Kg kept at a height of 5m. (2 marks)

Que 12: State the factors on which potential energy of a body depends. (2 marks)

Que 13: An object of mass 12Kg is at a certain height above the ground. If the potential energy of the object is 480J, find the height at which the object is with respect to the ground. Given, \( g = 10 \text{ m/s}^2 \) (2 marks)
Appendix A-3a (xviii)
Formative Test XVIII (Physics)

Time: 45 Min  M. Marks: 27

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read all the directions carefully.

Que 1: Fill in the blanks: (1 x3=3marks)
(i) The change of one form of energy into another is known as ______________.
(ii) S.I unit of energy is ____________.
(iii) One horse power is equal to ________ watt.

Que 2: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1 x4=4marks)
(i) A solar cell converts solar energy into
   (a) Heat Energy  (b) Chemical Energy  
   (c) Mechanical Energy  (d) Electrical Energy

(ii) The commercial unit of energy is
   (a) Watt  (b) Watt second  (c) kWh  (d) Joule

(iii) One kWh is equal to
   (a) 3.6 x 10^4 J  (b) 3.6 x 10^5 J  (c) 3.6 x 10^6 J  (d) 3.6 x 10^7 J

(iv) A machine does a work of 25000 J in 3 min and 20 sec. The power of machine is
   (a) 1.25 kw  (b) 0.125 kw  (c) 12.5 kw  (d) 125 kw

Que 3: Complete the incomplete statement: (1 x4=4marks)
(i) A body is allowed to fall under the influence of gravity from a height h. Its
   (a) Potential energy becomes maximum when ________________________.
   (b) Potential energy equals kinetic energy ________________________________.
   (c) Kinetic energy becomes maximum ________________________________.

(ii) Power of an agent is said to be one watt ________________________________.
Que 4: An object of mass 20 kg is dropped from a height of 4 m. Fill in the blanks by computing potential energy and kinetic energy in each case. (6 marks)

<table>
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<tr>
<th>Height at which object is located (m)</th>
<th>P.E (J)</th>
<th>K.E (J)</th>
<th>T.E=P.E+ K.E (J)</th>
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Que 5: Match the following three columns: (1 x 4 = 4 marks)

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<tr>
<th>Activities</th>
<th>Energy Conversions</th>
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<tr>
<td>A. Thermal Power Station</td>
<td>From</td>
</tr>
<tr>
<td>B. Nail is hammered into plank</td>
<td>Muscular Energy</td>
</tr>
<tr>
<td>C. Brakes are applied in a moving vehicle</td>
<td>Chemical Energy</td>
</tr>
<tr>
<td>D. On releasing the string of the bow</td>
<td>Potential Energy</td>
</tr>
<tr>
<td></td>
<td>To</td>
</tr>
<tr>
<td></td>
<td>a. Kinetic Energy</td>
</tr>
<tr>
<td></td>
<td>b. Heat, Light &amp; Sound Energy</td>
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<td>c. Heat &amp; Sound Energy</td>
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<td>d. Electrical Energy</td>
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Que 6: State the Law of Conservation of Energy with example. (2 marks)

Que 7: Define Power. (2 marks)

Que 8: Find the energy in kWh consumed in 10 hours by four devices of power 500 W each. (2 marks)
### Appendix A-3b

**Formative Tests-Sensitivity Indices**

Sensitivity Indices of Formative Tests of Chemistry

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**Sensitivity Indices of Formative Tests of Biology**

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Appendix A-4a (i)
Summative Test 1
Module I (Chemistry)

Time: 50 Minutes  M.Marks: 50

Note: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read the directions carefully.

Section A

Que 1: Fill in the blanks by writing one word only (1 × 5=5 marks)

(i) An Indian Philosopher, ____________, was the first to propose that matter is composed of very small particles, called ____________.
(ii) Law of Conservation of mass was given by ____________.
(iii) Atomic radius is measured in ____________.
(iv) Modern symbol of elements was proposed by ____________.
(v) The number of atoms present in one molecule of an element is called its ____________.

Section B: Multiple Choices Question

Que 2: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1 × 5=5 marks)

(i) One nanometer (nm) is equal to
   (a) 10^7          (b) 10^9
   (c) 10^10         (d) 10^12

(ii) Cation is formed by
   (a) gain of electrons          (b) gain of proton
   (c) loss of electron          (d) loss of proton

(iii) Formula mass of Calcium Chloride (At. Mass Ca =40, Cl=35.5)
   (a) 106 u                  (b) 110.5 u
   (c) 111 u                 (d) 111.5 u

(iv) Choose the correct statement
   (a) Law of constant proportion was given by Lavoisier.
   (b) Law of conservation of mass was given by Proust.
   (c) Law of constant proportion was given by Proust.
   (d) Law of constant proportion was given by Dalton.

(v) Choose the correct statement
   1. An ion is positively charged atom.
   2. An ion is positively or negatively charged atom.
   3. An ion is electrically neutral atom.
   4. An ion is negatively charged atom.
Section C

Que 3: Complete the incomplete statement in not more than two lines (1 × 3 = 3 marks)

(i) The law of conservation of mass can be explained with the help of postulates of Dalton's atomic theory that states __________________________.

(ii) Atomic mass unit is equal to __________________________.

(iii) Anion is negatively charged because __________________________.

Que 4. State the chemical symbol for the following compounds- (6 marks)

(i) Sodium ________ (ii) Potassium ________ (iii) Gold ________

(iv) Mercury ________ (v) Cobalt ________ (vi) Lead ________

Que 5. Write the atomicity of the following (6 marks)

(i) Neon ________ (ii) Ozone ________ (iii) Phosphorus ________

(iv) Oxygen ________ (v) Sodium ________ (vi) Sulphur ________

Section D

Que 6: Define matter. (1 mark)

Que 7: Define atom. (1 mark)

Que 8: Define atomic mass. (1 mark)

Que 9: Name any two laws of chemical combination. (1 mark)

Que 10: What is molecule? Explain with examples (2 marks)

Que 11: State the law of conservation of mass. Give one example to illustrate this law. (2 marks)

Que 12: State the law of constant proportion. Give one example to illustrate this law. (2 marks)

Que 13: State various postulates of Dalton's Atomic theory of matter. (3 marks)

Que 14: How can Dalton's atomic theory explain the law of constant proportion? (2 marks)

Que 15: Give one major drawback of Dalton's atomic theory. Give reason for your answer. (2 marks)

Que 16: What is the difference between molecule of an element and molecule of a compound? Give an example of each. (2 marks)

Que 17: Hydrogen and oxygen combine in the ratio of 1:8 by mass to form water. What mass of oxygen gas be required to react completely with 3 g of hydrogen gas? (2 marks)

Que 18: In an experiment, 4.90 g of copper oxide was obtained from 3.92 g of copper. In another experiment 4.55 g of copper oxide gave, on reduction, 3.64 g of copper. Show that these figures verify the law of constant proportions (2 marks)

Que 19: Calculate the molecular mass of Nitric acid, HNO₃ (At. Masses: H=1 u, N=14 u, O=16 u). (2 marks)

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Appendix A-4a (ii)
Summative Test II
Module II (Chemistry)

Time: 45 minutes  M.Marks: 45

Note: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory
(iii) Marks allotted for each question is given against every question
(iv) Read the directions carefully.

Section A
Que 1: Fill in the blanks with one word only (1×3 = 3 marks)
(i) Ionic compounds are formed between _______ and ________.
(ii) Gram atomic mass represents the mass of ________ particles.
(iii) Avogadro’s numbers (N) is numerically equal to ____________.

Section B: Multiple Choices Question
Que 2: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1×3=3 marks)
(i) The unit of molar mass is
   (a) u (b) a.m.u (c) g/mol (d) g

(ii) Number of molecules present in 28g of Nitrogen molecule
   (a) 12.044 × 10^{23}  (b) 6.023 × 10^{23}
   (c) 12.044 × 10^{20}  (d) 6.023 × 10^{24}

(iii) The mass of 4 moles of aluminum atom is
   (a) 108 g/mol (b) 98 g  (c) 98 g/mol (d) 108 g

Section C
Que 3: Correct the following statement by giving reason: (1×2=2 marks)
1) Molecular compounds are formed by the combination of two different metals atoms.

2) While writing the name of ionic compound the name of metal is changed by adding suffix ‘ide’.

Que 4: State whether the following statements are true or false. Write T for true and F for false statements (1×3=3 marks)
(i) Molar mass of a substance is mass of 6.022×10^{23} particles of that substance. ( )
(ii) The SI unit of amount of substance is kilograms. ( )
(iii) One mole consists of 6.022×10^{23} particles. ( )

cxlix
Section D

Que 5: Complete the incomplete statement in not more than two lines. (1×2=2marks)
(i) Chemical formula of a compound represents______________________.
(ii) Mole is defined as that amount of substance which contains__________.

Que 6: Write the symbol and valency of the following (1×8=8marks)
(i) Oxygen              (ii) Sulphur
(iii) Chlorine          (iv) Phosphorous
(v) Cuprous ion         (vi) Oxide ion
(vii) Ammonium ion      (viii) Bicarbonate ion

Que 7: Write the name of the following molecular compounds. (1×6=6marks)
(i) PCl₃               (ii) H₂S
(iii) N₂O₄              (iv) Mg(NO₃)₂
(v) MgCl₂

Que 8: Write the chemical formula for the following compounds (1×8=8marks)
(i) Sodium Oxide       (ii) Calcium Hydroxide
(iii) Sulphur Dioxide   (iv) Carbon Tetra Bromide
(v) Calcium Carbonate  (vi) Aluminium Sulphate
(vii) Magnesium Nitrite (viii) Potassium Sulphate

Section E

Short Answer Question

Que-9: An element X has valency of 2. Write the formula of its Bromide.

Que-10: Calculate the molar mass of Phosphorous (P₄). (At. mass P = 31.4)

Que-11: How many moles are present in 100 grams of Iron. (At. mass Fe = 56.4)

Que-12: Convert 22g of CO₂ into moles.

Que-13: If one mole of carbon atom weighs 12 g, what is mass in grams of one atom of Carbon?

(2×5=10marks)
Appendix A-4a (iii)
Summative Test III
Module 3 (Chemistry)

Time: 45 Minutes
M. Marks: 40

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory
(iii) Marks allotted for each question is given against every question
(iv) Read the directions carefully.

Section A
Que 1: Fill in the Blanks: (1×2=2 marks)
1. The subatomic particle not present in Thomson’s model of atom________.
2. α particles carries a charge of________ and mass of________.

Section B
Que 2: Match the column
Column A Column B
(1) Electron (a) Chadwick
(2) Proton (b) Goldstein
(3) Neutron (c) Thomson
(d) Rutherford

Que 3: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1×5=5 marks)
(i) Which of the following statement is incorrect about Rutherford model of the atom?
   (a) The nucleus is surrounded by negatively charged electron.
   (b) Nucleus is positively charged.
   (c) The size of the atom is almost equal to the size of its nucleus.
   (d) There is large empty space inside the nucleus.
(ii) The neutron makes the nucleus stable by
   (a) stabilizing the positive charge of proton and negative charge of electron
   (b) diluting the repulsive forces between positively charged nucleus
   (c) diluting the repulsive forces between negatively charged electron
   (d) All of these
(iii) As the distance of energy shell from nucleus increases, the energy associated with the shells
   (a) Increases (b) Decreases
   (c) No effect on energy (d) First increase then decreases
(iv) Atomic number represents
   (a) Number of protons present in the neutral atom
   (b) Number of electrons present in neutral atom
   (c) Number of electrons and protons in an ion
   (d) Both (a) and (b)
(v) Which of the following best defines the relationship between mass number and atomic number?
(a) Mass number = Atomic number − Number of neutrons
(b) Mass number = Atomic number + Number of neutrons
(c) Atomic number = Mass number + Number of neutrons
(d) Atomic number = Number of protons + Number of neutrons

Section C
Que 4: Complete the following statement in one or two lines (1×2=2 marks)
1. The atomic number of an element does not change during chemical reaction because
2. While calculating the mass number, the mass of electron is not taken into consideration because

Section D
Que 5: Correct the following statements (1×6=6 marks)
1. Neutrons and electrons are present outside the nucleus whereas protons are located inside the nucleus.
2. Proton is not present in Hydrogen atom.
3. The Rutherford's alpha particles scattering experiment leads to the discovery of neutron.
4. Nucleus is positively charged due to presence of neutron.
5. Electrons gain energy when they jump from higher energy level to lower energy level.
6. The atomic number of an element is equal to electrons in an ionic state.

Que 6: What is meant by mass number of an element? (1 mark)
Que 7: Explain Thomson's model of the atom. (2 marks)
Que 8: How did Neil Bohr explained the stability of atom? (2 marks)
Que 9: What important informations are furnished about the nucleus of an atom by the alpha particle scattering experiment of Rutherford? (2 marks)
Que 10: State one drawback of Rutherford's model of the atom. (2 marks)
Que 11: Write postulates of Bohr's model of atom. (3 marks)
Que 12: An atom of an element X may be represented as $^4X^0$, what does
(a) $^4X^9$ represent indicates
(b) Figure 4 indicates
(c) Number of protons in X
(d) Number of neutrons in X
(e) Number of electrons in X

Que 13: Helium atom has an atomic mass of 4u and two protons in its nucleus. How many protons does it have? (2 marks)
Que 14: Compare the properties of electron, proton and neutron highlighting the charge and mass in a.m.u and grams. (3 marks)
Appendix A-4a (iv)
Summative Test 1V
Module 4 (Chemistry)

Time: 40 Minutes  M. Marks: 35

NOTE: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read the directions carefully.

Section A

Que 1: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1×2=2 marks)

(1) Maximum number of electrons present in shell is given by
   (a) $2n^2$  (b) $n^2$  (c) $2n^2-1$  (d) $2n^2+1$

(2) Electronic configuration of the element is:
   (a) Distribution of electrons and protons in atom
   (b) Distribution of electrons in various shells
   (c) Given by symbol $aX^b$
   (d) Distribution of protons in various shells

Section B

Que 2: Fill in the blanks with one word (1×4=4 marks)

(1) Number of electrons present in any shell is governed by a rule, known as ___.
(2) Isotopes have different mass number because their nuclei contain different number of _____.
(3) The radioactive isotope used to determine the activity of thyroid gland: ___.
(4) The radioactive isotope used as a fuel in the reactors of nuclear power plant _____.

Que 3: Fill in the following blanks in respect of an atom of an element (3 marks)

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Que 4: Complete the following statement: in one to two lines (2 marks)
(1) Valency of non metal is determined by _________________.
(2) Valence electrons situated are situated in______________________.

Section C

Que 5: For the symbol H, D, T, write the subatomic particles (protons, neutrons and electrons) found in each one of them. (4 marks)

Que 6: The maximum number of electrons in the outermost shell is 8, even if it can accommodate more electrons. Explain by giving example. (2 marks)

Que 7: Why are noble gases inert or chemically inactive? (2 marks)

Que 8: Composition of the nuclei of two atomic species X and Y is given as under

X = Proton- 6, Neutron-6
Y = Proton- 6, Neutron-8

Give the mass number of X and Y. What is the relationship between the two species and which element they represent? (2 marks)

Que 9: Give that the percentage abundance of the isotope $^{10}\text{Ne}^{20}$ is 90% and that of the isotope $^{10}\text{Ne}^{22}$ is 10%, calculate the average atomic mass of neon. (3 marks)

Que 10: A sample of an element X contains two isotopes $^{16}\text{X}^{16}$ and $^{18}\text{X}^{18}$. If the average atomic mass of this sample of the element be 16.2 u, calculate the percentage of the two isotopes in this sample. (3 marks)

Q 11: Which two of the following pairs are isotopes and which are isobar?

(i) $^{26}\text{A}^{58}$ and $^{28}\text{B}^{58}$ (ii) $^{35}\text{X}^{79}$ and $^{35}\text{X}^{80}$

Give reasons for your choice. (3 marks)
Appendix A-4a (v)

Summative Test V
Module 5 (Biology)

Time: 55 Minutes
M. Marks: 55

Note: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory.
(iii) Marks allotted for each question is given against every question.
(iv) Read the directions carefully.

Section A

Que 1: Fill in the blanks with one word only (1×7=7 marks)
1. Outermost covering of the cell is called ________.
2. The main constituent of cell wall is ________.
3. Undefined nuclear region containing only nucleic acid is called ________.
4. The fluid content inside the plasma membrane is known as ________.
5. SER helps in the synthesis of ________.
6. Energy is stored in the cells in the form of ________.
7. Vacuoles are also known as ________.

Section B

Que 2: State whether the following statements are true or false (1×5=5 marks)
1. Cell wall lies inside of plasma membrane. ( )
2. Cell wall is a non living wall. ( )
3. Ribosomes are present in endoplasmic reticulum. ( )
4. Colourless plastids are known as chromoplasts ( )
5. If plant cell is placed in concentrated solution, the cell will gain water ( )

Section C

Que 3: Match the plastids given in column A with their functions given in column B (3 marks)

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
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<tbody>
<tr>
<td>1. Leucoplast</td>
<td>a. Photosynthesis</td>
</tr>
<tr>
<td>2. Chromoplast</td>
<td>b. Provides colour to leaves and flowers</td>
</tr>
<tr>
<td>3. Chloroplast</td>
<td>c. Storage of food</td>
</tr>
</tbody>
</table>

Que 4: Write the name of the scientist who has discovered the following: (4 marks)
1. Cell
2. Protoplasm
3. Nucleus
4. Cell theory

Section D

Que 5: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1×6=6 marks)

(i) In diffusion substances move from region of
   (a) Higher concentration to lower concentration
   (b) Lower concentration to higher concentration
   (c) Higher concentration to lower concentration through semi permeable membrane
   (d) Lower concentration to higher concentration through semi permeable membrane

clv
(ii) Roots of plants absorb water through the process of
(a) Osmosis (b) Diffusion
(c) Absorption (d) both a & b

(iii) Amoeba acquires its food through the process of
(a) Osmosis (b) Diffusion
(c) Endocytosis (d) Plasmolysis

(iv) Genes are located on
(a) Ribosomes (b) Chromosomes
(c) Mitochondria (d) Golgi apparatus

(v) The site for protein synthesis in cell is
(a) Nucleus (b) Ribosomes
(c) Cytoplasm (d) Golgi apparatus

(vi) Cellular respiration is carried in
(a) Mitochondria (b) Nucleus
(c) Lysosomes (d) Golgi apparatus

Section E

Que 6: Complete the following incomplete statements in one or two lines (2x5=10 marks)
1. Cell is called structural and functional unit of life because.
2. Cell membrane is selectively permeable because.
3. Osmosis is defined as process in which.
4. Lysosomes are called suicidal bags because.
5. Mitochondria can make their own proteins because.

Section F

Que 7: What is the main function of Chromosome? (1 mark)
Que 8: What is Chromatin material? (1 mark)
Que 9: Write the name of different types of endoplasmic reticulum? (1 mark)
Que 10: Name two cell organelles which have their own DNA and ribosomes? (1 mark)
Que 11: Define plasmolysis. (1 mark)
Que 12: Which organelle is the power house of cell? Justify. (2 marks)
Que 13: How do substances like CO₂ and O₂ move in and out of the cell? Discuss. (2 marks)
Que 14: What happens when dried raisins are put into:
1. Pure water
2. Concentrated sugar solution (2 marks)
Que 15: What is Golgi body? Discuss its function. (3 marks)
Que 16: Differentiate between prokaryotic cell and eukaryotic cell by giving one example of each. (3 marks)
Que 17: Draw the structure of animal cell. (3 marks)
Appendix A-4a (vi)

Summative Test VI
Module 6 (Biology)

Time: 45 Minutes  M. Marks: 50

Note: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory
(iii) Marks allotted for each question is given against every question
(iv) Read the directions carefully.

Section A

Que 1: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer.

(i) A group of cells alike in form, function and origin is called
   (a) Tissue  (b) Organ
   (c) Organelle  (d) None of these

(ii) In which of the following tissues, cells are thickened at the corner
   (a) Collenchyma  (b) Parenchyma
   (c) Schlenchyma  (d) None of these

(iii) Grass stem elongates by the activity of
   (a) Primary meristem  (b) Intercalary meristem
   (c) Secondary meristem  (d) Apical meristem

(iv) Which of the following is a complex tissue
   (a) Xylem  (b) Parenchyma
   (c) Collenchyma  (d) Sclerenchyma

(v) The living component of Xylem is
   (a) Vessels  (b) Xylem Parenchyma
   (c) Xylem Sclerenchyma  (d) Tracheids

(vi) The walls of cork cells are thickened by the deposition of
   (a) Lignin  (b) Pector
   (c) Suberin  (d) cellulose

(vii) Lignified elongated dead cells are
   (a) Parenchyma  (b) Sclerenchyma
   (c) Collenchyma  (d) None of these

(viii) Complete tissue consists of
   (a) Different types of cells carrying out the same function
   (b) Different types of cells carrying out different functions.
   (c) Same types of cells having the same origin and carry the same function.
   (d) Different types of cells having the same origin and carrying the same function.
Section B

Que 2: Mark the following statements as T or F (1x5=5 marks)

1. Cambium has the apical meristem. ( )
2. Totipotency exists in meristematic cells. ( )
3. Aerenchyma provides buoyancy to the aquatic. ( )
4. Parenchyma cells provide tensile and mechanical strength. ( )

Section C

Que 3: Complete the following statements in one or two lines: (1x5=5 marks)

1. Differentiation is a process by which cells______________________________.
2. Vascular bundles consist of__________________________________________.
3. The function of epidermis in plants is_______________________________.
4. Intercalary meristem is present in____________________________________.
5. The most important element of phloem is______________________________.

Que 4: Write down the function of the following (1x4=4 marks)

1. Apical meristem_______________________________.
2. Lateral meristem_______________________________.
3. Intercalary meristem_______________________________.
4. Epidermis_______________________________.

Que 5: Write one word for the following (1x5=5 marks)

1. Tissue present in husk of coconut_______________________________.
2. Plant tissue concerned with transportation of food_______________________________.
3. Plant tissue concerned with conduction of water and minerals_______________________________.
4. Component of phloem that is dead_______________________________.
5. Tissue which acts like a sponge in hydroscopic plants_______________________________.

Section D

Que 6: What is the unique characteristic feature of meristem? (1mark)

Que 7: What are permanent tissues? (1mark)

Que 8: Differentiate between simple permanent tissue and complex permanent tissue. (2 marks)

Que 9: Differentiate between meristematic tissue and permanent tissue. (2 marks)

Que 10: Differences between Parenchyma and collenchyma. (2 marks)

Que 11: Differentiate between Xylem and Phloem. (2 marks)

Que 12: Draw a flow sheet to show various types of tissues found in plants. (3 marks)

Que 13: Differentiate between tracheids and vessels in one or two sentences for each. (2 marks)

Que 14: Explain the structure of phloem with well labeled diagram. (4 marks)

Que 15: Explain the structure and function of stomata with diagram. (4 marks)
Appendix A-4a (vii)
Summative Test VII
Module 7 (Biology)

Time: 55 Minutes M. Marks: 50

Note: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory
(iii) Marks allotted for each question is given against every question
(iv) Read the directions carefully.

Section A

Que 1: Multiple choice questions: only one option is right, choose the correct one

(i) Skin of hand is an/a (1 * 7=7 marks)
   (a) Connective tissue
   (b) Epithelial tissue
   (c) Nervous tissue
   (d) Muscular tissue

(ii) Involuntary muscles are (1 * 7=7 marks)
   (a) Striated muscles
   (b) Non-striated Muscles
   (c) cardiac muscles
   (d) Both (b) and (d)

(iii) Sarcolemna is plasma membrane of (1 * 7=7 marks)
   (a) Epithelial cells
   (b) Muscle cells
   (c) Connective tissue
   (d) Nervous Tissue

(iv) Mitochondria are more in (1 * 7=7 marks)
   (a) Striated muscles
   (b) cardiac muscles
   (c) Smooth muscles
   (d) All of the above

(v) Fluid part of blood after removal of corpuscles is (1 * 7=7 marks)
   (a) Plasma
   (b) Lymph
   (c) Serum
   (d) Platelets

(vi) The basement membrane of epithelial cells contain a protein called (1 * 7=7 marks)
   (a) Callogen
   (b) Histogen
   (c) Albumin
   (d) Cutin

(vii) The animal tissue whose cells divide throughout the life (1 * 7=7 marks)
   (a) Connective Tissue
   (b) Epithetical tissues
   (c) Muscle Tissue
   (d) Neurons

Section B

Que 2: Give one word for the following: (1 * 5=5 marks)

1. Tissues that are found in lining of stomach and intestine of vertebrate

2. Tissues that forms inner lining of our mouth

3. Tissues that connect muscle to bone in human

4. Muscle which works throughout life and is defatigable

5. The protective tissue in animal body is

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Section C
Que 3: State whether the following statements are True or False
1. In human body fats are stored in Areolar connective tissue
2. Nervous tissues are present in brain and spinal cord
3. Cuboidal epithelium is present in glands such as liver, thyroid
4. Tendons connect one bone to another bone.

Section D
Que 4: Differentiate between columnar epithelium and ciliated epithelium on the basis of their occurrence and function

Que 5: Give four important functions of epithelial tissue. Name one specific place in the body where each function is carried out.

Que 6: Name the place in living organisms, where the following tissues are located:
1. Skeletal muscles
2. Smooth muscles
3. Cardiac muscles

Que 7: Differentiate between striated smooth and cardiac muscles on the basis of their structure and nucleus present

Que 8: Draw the structure of all types of cardiac muscle.

Que 9: Complete the incomplete statement in one to two lines
1. Connective tissues are those that
2. The main function of lymph is
3. Nervous tissues help in

Que 10: Differentiate between cartilage and bone.

Que 11: What is areola tissue?

Que 12: Discuss important functions of blood.

Que 13: Draw and label the diagram of nerve cell.

Que 11: Complete the table

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Appendix A-4a (viii)

Summative Test VIII
Module 8 (Physics)

Time: 45 Minutes  M. Marks: 40

Note: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory
(iii) Marks allotted for each question is given against every question
(iv) Read the directions carefully.

Section A

Que 1: Answer the following questions by choosing the best option from the given options. There is only one right answer. Tick the right answer. (1x5=5marks)

(1) Work is said to be done when
   (a) Force is applied and object moves
   (b) Force is applied and object does not move
   (c) An object gets displaced in the absence of force acting on it
   (d) All of these

(2) Mechanical energy is sum total of
   (a) Kinetic energy and chemical energy
   (b) Kinetic energy and potential energy
   (c) Electrical energy and light energy
   (d) Electrical energy and potential energy

(3) Kinetic energy of the body gets doubled, when
   (a) Mass of body is doubled
   (b) Mass of body reduced to half
   (c) Mass of body is increased 4 times
   (d) mass is increased ¼ times

(4) If speed of car is doubled, the kinetic energy of car increases
   (a) 4 times
   (b) 8 times
   (c) remain same
   (d) doubles

(5) Kinetic energy possessed by a body of mass 10 Kg, moving with a speed of 40m/s
   (a) 8000J
   (b) 2000J
   (c) 200J
   (d) 16000J

Section B

Que 2: Fill in the blanks with one word only (1x3=3marks)

(1) Work done will be greater when force applied is_____ and distance is_________

(2) Work is a __________ quantity

(3) S.I unit of work is ________
Section C

Que 3: Correct the following statement, giving reason (2 marks)
(1) Energy and work are vector quantities.

Que 4: Complete the following statement in not more than two lines. (1x2=2 marks)
(1) S.I. unit of energy is defined as ___________________________.
(2) Kinetic energy is defined as ___________________________.

Que 5: Write the formula for the following (1x3=3 marks)
(1) Work done by constant force
(2) Work done against gravity
(3) Work done on a body when it moves at an angle \( \theta \)

Section D

Que 6: Look at the following activities listed below. Reason out whether or not work is done in the light of your understanding of the term work. (2x3=6 marks)
(1) Suma is swimming in a pond
(2) A donkey is carrying a load on its back
(3) Brakes are applied to a moving car.

Que 8: Calculate the momentum of a body of mass 10g and energy 80J (2 marks)

Que 9: Calculate the speed of a stone which possesses kinetic energy of 20J and mass of 100g. (2 marks)

Que 10: Calculate the work done when a force of 7 N displaces an object through 8 m in the direction of force. (2 marks)

Que 11: A potter lifts a luggage of 15 Kg from the ground and puts it on his head 1.5m above the ground. Calculate the work done by him on the luggage. (2 marks)

Que 12: A child pulls a toy car through a distance of 10 m on a smooth horizontal surface. If the force applied by the child be 5N, calculate the work done by the child in pulling the toy car. (2 marks)

Que 13: Derive an expression for the kinetic energy of an object. (3 marks)

Que 14: Define and explain positive, negative and zero work by giving suitable examples. (6 marks)
Appendix A-4a (ix)
Summative Test IX
Module 9 (Physics)

Time: M. Marks: 35

Note: (i) Do not write anything on question paper. Write only in the response sheet provided.
(ii) All the questions are compulsory
(iii) Marks allotted for each question is given against every question
(iv) Read the directions carefully.

Section A

Que 1: Fill in the blanks (1x4=4 marks)

(1) A man climbing hill posse ________ and ________ energy.
(2) When an arrow is stretched in a bow, ________ energy is converted into potential energy.
(3) Commercial unit of energy is ________.
(4) 1 kWh = ____________ Joule.

Section B

Que 2: Answer the following questions by choosing the best option from the given choices. There is only one right answer. Tick the right answer. (1x4=4 marks)

(i) If 1 joule of energy is applied to lift an object of 500g. How high will it rise?
   (a) 0.002m  (b) 0.2m  (c) 2m  (d) 500m

(ii) Two bodies of masses 10 kg and 20 kg respectively are kept at the same height from the ground. The ratio of potential energy of A to that of B is
   (a) 1:1  (b) 1:2  (c) 2:1  (d) none

(iii) 1 horse power is equal to
   (a) 746 Joules  (b) 746 Watt  (c) 746 kWh  (d) 746 erg

(iv) Which one of the following possess gravitational potential energy
   (a) Compressed string
   (b) Compressed gas in a cylinder
   (c) Water stored in a dam
   (d) Stretched bow and arrow.
Section C
Que 3: Complete the following incomplete statements: (1×5=5 marks)
(1) Potential energy of the body depends upon (i) __________________________.
    (ii) __________________________.
(2) Transformation of energy is defined as __________________________.
(3) Law of conservation of energy states that __________________________.
(4) Potential energy is defined as __________________________.

Section D
Que 4: Define average power. (1 marks)
Que 5: Differentiate between gravitational potential energy and elastic potential energy by giving example. (3 marks)
Que 6: Derive an expression for the potential energy of a body when it is falling to the ground under gravity. (2 marks)
Que 7: Gravitational potential energy is independent of the path followed. Justify by giving example. (2 marks)
Que 8: The potential energy of freely falling object decreases progressively. Does this violate the law of conservation of energy? Why (2 marks)
Que 9: A computer consumes 1000J of electrical energy in 10s. Calculate its power? (2 marks)
Que 10: An electric heater is rated 1500w. How much energy in kWh does it use in 10 hrs? (2 marks)
Que 11: a boy of mass 50 kg runs a staircase of 45 steps in 9s. If the height of each step is 15cm, find his power. Take g=10ms⁻¹ (2 marks)
Que 12: What happens to the potential energy of a body when (3 marks)
    (a) Height is doubled
    (b) Mass is doubled
    (c) Body is taken to the moon.
Que 13: Explain the energy changes in the following cases: (3 marks)
    1) In riding a bicycle
    2) When brakes are applied in any moving vehicle
    3) When hands are rubbed

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## Appendix A-4b

### Summative Tests-Sensitivity Indices

#### Sensitivity Indices of Summative Test of Chemistry

**Summative Test I**

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### Sensitivity Indices of Summative Test of Biology

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### Sensitivity Indices of Summative Test of Physics

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