Support Material
(2015-2016)

**CLASS : X**

**SCIENCE**

Under the Guidance of:

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PREFACE

It gives me immense pleasure to present before you the subject-wise supporting material for the students of classes X, XI and XII, prepared by the teams of dedicated and industrious teachers from the Directorate of Education. The objective of this material is impart sufficient practice to the students and to enable them to think analytically and rationally.

I hope that the students will find this study material useful and it will help them achieve academic excellence. I also hope that teachers will guide and motivate the students to use this material in preparing for examinations.

I would like to appreciate the efforts of the teams of teachers and group leaders under the enlightened guidance of the Director (Education).

Wishing best of luck to all the students.

(SIGNATURE)

(PUNYA SAMILA SRIVASTAVA)
PREFACE

The Directorate of Education prepares Support Material for different subjects indigenously. Every year, experienced and knowledgeable teachers revise and update the material for children.

Support material is a boon especially for those children who cannot purchase the costly but substandard ‘guides’ available in the market. Prepared in-house, the material is not only much better in quality, it is also provided to the students free of cost.

The material can serve as a very handy tool for revision. I call upon the teachers to give their students sufficient practice in it.

I must share with the students that this material has the potential to enhance your performance and output, remarkably. So, please make it a habit to go through the textbook first and then, practice from the Support Material.

I take this opportunity to thank all the learned teachers and HoSs who have contributed to the preparation/revision these works.

My best wishes!

(PADMINI SINGLA)
FOREWARD

I am delighted to present before you the latest issues of the support material for the students of classes X, XI and XII. During the last few years the content and quality of the support material has undergone subtle changes. Teams of subject experts have devoted their time, efforts and energy to prepare this material which facilitates the students while preparing for their exams. The material is updated according to the latest changes and improvements which have been carried out by the CBSE and NCERT.

I hope that our teachers will give sufficient practice to their students through this material which in turn will improve their creative and analytical skills.

I appreciate the hard work of all the teachers, group leaders and members of the Examination Branch whose efforts have materialized in the form of these books.

I wish you all the best.

Dr. Sunita S. Kaushik
Addl. Director of Education
(School and Exam)
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<thead>
<tr>
<th>Sl No.</th>
<th>Name</th>
<th>Designation</th>
<th>Name of the School</th>
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</thead>
<tbody>
<tr>
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<tbody>
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</table>
### QUESTIONS PAPER DESIGN FOR SCIENCE (CODE NO. 086/090)
#### CLASS - X (2015-16)

**Time - 3 hrs.**

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Typology of Questions</th>
<th>V. Short Ans. (VSA) (1 Mark)</th>
<th>Short Ans.-I(SA) (2 Mark)</th>
<th>Short Ans.-II(SA) (3 Mark)</th>
<th>Long Ans.(LA) (4 Mark)</th>
<th>Total Marks</th>
<th>% Weightage</th>
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<tbody>
<tr>
<td>1.</td>
<td>Remembering - (Knowledge based Simple recall questions, to know specific facts, terms, concepts, principles, or theories, identify, define, or recite, information)</td>
<td>3</td>
<td>-</td>
<td>1</td>
<td>11</td>
<td>15</td>
<td>15%</td>
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<tr>
<td>2.</td>
<td>Understanding - (Comprehension to be familiar with meaning and to understand conceptually, interpret, compare, contrast, explain, paraphrase, or interpret information)</td>
<td>-</td>
<td>1</td>
<td>4</td>
<td>19</td>
<td>26</td>
<td>26%</td>
</tr>
<tr>
<td>3.</td>
<td>Application (Use abstract information in concrete situation, to apply knowledge to new situation; Use given content to interpret a situation, provide an example, or solve a problem)</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>17</td>
<td>23</td>
<td>23%</td>
</tr>
<tr>
<td>4.</td>
<td>High order thinking Skills (Analysis &amp; Synthesis - Classify, compare, contrast, or differentiate between different pieces of information; Organize and/or integrate unique pieces of information from a variety of sources)</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>9</td>
<td>12</td>
<td>12%</td>
</tr>
<tr>
<td>5.</td>
<td>Evaluation and Multi-Disciplinary (Appraise, judge, and/or justify the value or worth of a decision or outcome, or to predict outcomes based on values)</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>2</td>
<td>19</td>
<td>25%</td>
</tr>
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</table>

Total (Theory Based Questions) \[3 \times 1 = 3\] \[3 \times 2 = 6\] \[12 \times 3 = 36\] \[6 \times 5 = 30\] \[75(24)\] \[100%\]

Practical Based Questions (PBQs) \[9 \times 1 = 9\] \[3 \times 2 = 6\] - - \[15(12)\]

Total \[12 \times 1 = 12\] \[6 \times 2 = 12\] \[12 \times 3 = 36\] \[6 \times 5 = 30\] \[90(36)\]

*One question of 3 marks will be included to assess the values inherent in the texts.*
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CHAPTER – 4

CARBON AND ITS COMPOUNDS

- Carbon is a versatile element found in 0.02% in form of minerals and 0.03% in form of CO₂.
- All living structures are carbon based.

Covalent Bond in Carbon

The atomic number of carbon is 6.

**ELECTRONIC CONFIGURATION:**

\[
\begin{align*}
\text{K,} & \quad \text{L} \\
\text{Carbon} & \quad 2, & 4.
\end{align*}
\]

To attain a noble gas configuration:

1. It is difficult for an atom of carbon to either gain or lose electrons as it would be difficult to hold extra electrons and would require a large amount of energy to remove four electrons.

2. Carbon attains the noble gas configuration by sharing its valence electrons with other atoms. Atoms of other elements like hydrogen, oxygen, nitrogen, chlorine also show sharing of valence electrons.

\begin{align*}
\text{e.g. (a)} & \quad \text{H₂ molecule} \\
\text{A molecule of hydrogen} & \quad \text{shared electrons} \\
\text{H – H} & \quad \text{Single bond between two hydrogen atoms}
\end{align*}

\begin{align*}
\text{O₂ molecule} & \quad \text{double bond between two oxygen atoms}
\end{align*}
It is evident that the number of shared pair of electrons can be one, two or three. Try making the structures of H₂O and CH₂.

Bond formed by the sharing of an electron pair between two atoms is called covalent bond.

Covalently bonded molecules have low melting and boiling points because of comparatively weaker intermolecular forces, unlike ionic compounds.

These molecules are generally poor conductor of electricity since no charged particles are formed.

**Versatile Nature of Carbon Atoms**

Two important properties which enable carbon to form enormously large number of compounds.

I. **CATENATION** is property of carbon atom to form bond with other atoms of carbon. Like carbon, silicon forms compounds with hydrogen upto seven or eight atoms of silicon.

II. **TETRAVALENCY**: Having a valency of 4, carbon atom is capable of bonding with atoms of oxygen, hydrogen, nitrogen, sulphur, chlorine and other elements.
The smaller size of carbon atom enables nuclei nucleus to hold the shared pair of electrons strongly, thus carbon compounds are very stable in general.

**Saturated and Unsaturated Carbon Compounds**

- **ALKANE**: $\text{CH}_{2n+2}$
- **ALKENE**: $\text{C}_n\text{H}_{2n}$
- **ALKYNE**: $\text{C}_n\text{H}_{2n-2}$

- Electron dot structure of a saturated carbon compound, ethane is as follows:

- Electron dot structure of an unsaturated carbon compound, ethene is as follows:
TRY DRAWING THE ELECTRON DOT STRUCTURE OF ETHYNE

Formulae and Structures of Saturated Compounds of Carbon and Hydrogen

<table>
<thead>
<tr>
<th>No. of Carbon Atoms</th>
<th>Name</th>
<th>Formula</th>
<th>Structure</th>
</tr>
</thead>
</table>
| 1                   | Methane| CH₄     | H
|                     |        |         | H - C - H |
|                     |        |         | H       |
| 2                   | Ethane | C₂H₆    | H H
|                     |        |         | H - C - C - C - H |
|                     |        |         | H H     |
| 3                   | Propane| C₃H₈    | H H H
|                     |        |         | H - C - C - C - H |
|                     |        |         | H H H   |
| 4                   | Butane | C₄H₁₀   | H H H H
|                     |        |         | H - C - C - C - C - H |
|                     |        |         | H H H H |
| 5                   | Pentane| C₅H₁₂   | H H H H H
|                     |        |         | H - C - C - C - C - H |
|                     |        |         | H H H H H |
On the basis of structures the hydrocarbons can be:

Straight chain  Branched  Cyclic saturated  Cyclic unsaturated

**Add: Example**

CYCLOHEXANE ($C_6H_{12}$)  BENZENE ($C_6H_6$)

**Structural isomers**: these are the compounds having identical molecular formula but different structures. For example, isomers of butane.
Heteroatom and Functional Group

- In hydrocarbon chain, one or more hydrogen atoms can be replaced by other atoms in accordance with their valencies. The element that replaces hydrogen is called a heteroatom.

- These heteroatoms and the group containing them impart chemical properties to the compound and hence are called functional groups.

<table>
<thead>
<tr>
<th>Heteroatom</th>
<th>Functional Group</th>
<th>Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cl/Br</td>
<td>Halo-(Chloro/Bromo)</td>
<td>−Cl, -Br</td>
</tr>
<tr>
<td>Oxygen</td>
<td>1. Alcohol</td>
<td>−OH</td>
</tr>
<tr>
<td></td>
<td>2. Aldehyde</td>
<td>−C≡H</td>
</tr>
<tr>
<td></td>
<td>3. Ketone</td>
<td>−C−O</td>
</tr>
<tr>
<td></td>
<td>4. Carboxylic acid</td>
<td>−C-OH</td>
</tr>
</tbody>
</table>

Homologous Series

- It is a series of compounds in which the same functional group substitutes for hydrogen in a carbon chain.

- For instance, the ALCOHOLS: CH₃OH, C₂H₅OH, C₃H₇OH, C₄H₉OH.

- The successive member differs by −CH₂; unit and 14 units of mass.

- The chemical properties are imparted by the functional group thus all members have similar chemical properties. But the members have different physical properties.

- The physical properties vary among the members of homologous series due to difference in their molecular mass.
Melting point and boiling point increases with increasing molecular mass.

**Nomenclature of Carbon Compounds**

1. Identify the number of carbon atoms in the compound.

2. Functional group is indicated either by prefix or suffix.

<table>
<thead>
<tr>
<th>Functional Group</th>
<th>Suffix</th>
<th>Prefix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alkene</td>
<td>ene</td>
<td></td>
</tr>
<tr>
<td>Alkyne</td>
<td>yne</td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>ol</td>
<td></td>
</tr>
<tr>
<td>Aldehyde</td>
<td>al</td>
<td></td>
</tr>
<tr>
<td>Ketone</td>
<td>one</td>
<td></td>
</tr>
<tr>
<td>Carboxylic acid</td>
<td>oic acid</td>
<td></td>
</tr>
<tr>
<td>Chlorine</td>
<td>chloro</td>
<td></td>
</tr>
</tbody>
</table>

3. If a suffix is added, then final ‘e’ is removed from the name e.g. methanol (methane-e = methan + ol).

**Chemical Properties of Carbon Compounds**

1. **COMBUSTION**

   - Carbon compounds generally burn (oxidize) in air to produce carbon dioxide and water, and release heat and light energy.

     \[ \text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{heat and light} \]

   - Saturated hydrocarbon burns generally with a blue flame in good supply of air and with a yellow sooty flame in limited supply of air.

   - Sooty flame is seen when unsaturated hydrocarbons are burnt.

   - Burning of coal and petroleum emits oxides of sulphur and nitrogen which are responsible for acid rain.

2. **OXIDATION**:

   - Alcohols can be converted to carboxylic acids by oxidizing them using alkaline potassium permanganate or acidified potassium dichromate (they add oxygen to the reactant, thus are called oxidizing agents).
3. ADDITION REACTION

Hydrogen is added to unsaturated hydrocarbon in presence of palladium or nickel as catalyst.

Vegetable oils are converted into vegetable ghee using this process.

So this process is also known as hydrogenation reaction/process

\[
\text{CH}_3-\text{CH}_2\text{OH} + \text{H}_2 \xrightarrow{\text{Nickel catalyst}} \text{CH}_3\text{COOH}
\]

Saturated fatty acids are harmful for health and oils with unsaturated fatty acids should be used for cooking.

4. SUBSTITUTION REACTION

In saturated hydrocarbons, the hydrogen attached to carbon can be replaced by another atom or group of atoms in presence of sunlight.

\[
\text{CH}_4 + \text{Cl}_2 \rightarrow \text{CH}_3\text{Cl} + \text{HCl} \quad \text{(sunlight required)}
\]

**IMPORTANT CARBON COMPOUNDS : Ethanol and Ethanoic Acid Ethanol**

- **Ethanol**
  - Melting Point 156k
  - Boiling Point 351 k
  - Soluble in Water
  - Burning Taste

- Consumption of dilute ethanol causes serious health issues and intake of pure alcohol is lethal.

**CHEMICAL PROPERTIES OF ETHANOL**

- \(\text{C}_2\text{H}_5\text{OH}\) reacts with **Sodium** to from **Sodium Ethoxide** and **Hydrogen**
- **When \(\text{C}_2\text{H}_5\text{OH}\) is heated with concentrated Sulphuric Acid at 443 K, it is dehydrated to Ethene**
Ethanoic Acid (CH₃COOH) / Acetic Acid:

- Freezes at 290 k
- Boiling Point 391 k
- Miscible in Water
- Sour Taste

- 5-8% solution of acetic acid in water is called vinegar.
- Pure acetic acid is called glacial acetic acid.

<table>
<thead>
<tr>
<th>REACTS WITH</th>
<th>PRODUCTS</th>
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<tr>
<td><strong>ETHANOIC ACID</strong></td>
<td></td>
</tr>
<tr>
<td>1 Sodium</td>
<td>Sodium ethanoate and hydrogen</td>
</tr>
<tr>
<td>Na</td>
<td></td>
</tr>
<tr>
<td>2 Sodium Carbonate</td>
<td>Sodium ethanoate, carbon dioxide and water</td>
</tr>
<tr>
<td>Na₂CO₃</td>
<td></td>
</tr>
<tr>
<td>3 Sodium Bicarbonate</td>
<td>Sodium ethanoate, carbon dioxide and water</td>
</tr>
<tr>
<td>NaHCO₃</td>
<td></td>
</tr>
<tr>
<td>4 Ethanol (in presence of conc. sulphuric acid)</td>
<td>Ester and water</td>
</tr>
<tr>
<td>CH₃-CH₂OH</td>
<td></td>
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</tbody>
</table>
Esterification

Carboxylic acids react with alcohols in presence of few drops of concentrated sulphuric acid as catalyst and form sweet smelling compounds called ester.

\[
\text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COOH} + \text{conc.} \text{H}_2\text{SO}_4 \rightarrow \text{CH}_3\text{COOC}_2\text{H}_5
\]

Hydrolysis

On heating with an acid or a base the ester forms back the original alcohol and carboxylic acid.

\[
\text{CH}_3\text{COOCH}_2\text{CH}_3 + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{CH}_3\text{CH}_2\text{OH}
\]

\[
\text{CH}_3\text{COOCH}_2\text{CH}_3 \xrightarrow{\text{Dil.} \text{H}_2\text{SO}_4 \text{ HEAT}} \text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{OH}
\]

- Alkaline hydrolysis of ester is also called saponification.

Soaps and Detergents

- Soap is sodium and potassium salt of carboxylic acids with long chain.
- Soaps are effective with soft water only and ineffective with hard water.
- Detergents are ammonium or sulphonate salts of carboxylic acids with long chain. They are effective with both soft as well as hard water.

An ionic part (hydrophilic) and a long hydrocarbon chain (hydrophobic) part constitutes the soap molecule.
Structure of a Soap molecule.

**Cleansing Action of Soaps**

- Most dirt is oily in nature and the hydrophobic end attaches itself with dirt, while the ionic end is surrounded with molecules of water. This results in the formation of a radial structure called micelles.

- An emulsion is thus formed by soap molecule. The cloth needs to be mechanically agitated to remove the dirt particles from the cloth.

- **Scum**: The magnesium and calcium salts present in hard water react with soap molecule to form insoluble products called scum, thus obstructing the cleansing action. Use of detergents overcome this problem as the detergent molecule prevents the formation of insoluble product and thus clothes get cleaned.

**QUESTION BANK**

**1 MARK**

1. How does an atom of carbon attain noble gas configuration?

2. Draw the electron dot structure of a molecule of water.
3. Define catenation.

4. The kerosene/gas stove used at home has inlets for air. Give reason.

5. Write only the balanced chemical equation for dehydration of ethanol by hot conc. sulphuric acid.

6. Write the number of covalent bonds present in propane.

7. Define the term: oxidising agent with an example

8. Write the formula and name of first member of ketone.

9. Would you be able to check if water is soft by using a soap?

10. Write the molecular formula of an alkyne containing 10 atoms of hydrogen.

(2 MARKS)

1. Define saponification. Write a chemical equation for it.

2. Covalent compounds generally don’t conduct electricity. Why?

3. Specify the condition in which ethanol undergo oxidation to form ethanoic acid. Write the chemical equation.

4. Define isomerism. Draw the structures of the two isomers of butane.

5. Identify the functional group present in the following compounds: HCOOH, HCHO, CH₃Br and C₁₀H₂₁OH.

6. Why is ethanoic acid called as glacial acetic acid. Write the equation of the reaction that takes place when ethanoic acid reacts with ethanol in the presence of conc. H₂SO₄.

7. Draw that structures of the following compounds – (a) methanoic acid (b) pentanal.

8. Why are carboxylic acids called as weak acids? Name the alcohol which produces methanoic acid on oxidation.

9. (i) Which property of ethanol makes it suitable for preparing medicines such as tincture iodine, cough syrup and other tonics.
(ii) What is the function of concentrated sulphuric acid in the formation of ethane from ethanol?

10. Define esterification. Explain with an example.

(3 MARKS)

1. What is a homologous series? Write any two characteristic features of any homologous series using one example.

2. Write any three differences between soaps and detergents.

3. Write the main difference between addition and substitution reactions. Which reaction is commonly used in the hydrogenation of vegetable oil.

(5 MARKS)

1. Differentiate between ethanol and ethanoic acid on the basis of any three physical properties and two chemical properties.

2. An organic compound ‘A’ is used as a preservative in pickles and has molecular formula C₄H₉O₂. This compound reacts with ethanol to form a sweet smelling compound ‘B’.
   
   (i) Identify the compound ‘A’ and write the chemical formula and chemical name.
   
   (ii) Write the chemical equation for its reaction with ethanol to form compound ‘B’.
   
   (iii) Write any two uses of compound ‘B’.
   
   (iv) Which gas is produced when compound ‘A’ reacts with washing soda? Write the balanced chemical equation.
   
   (v) How can vinegar be obtained from compound ‘A’?

REACTION SUMMARY

(1) COMBUSTION REACTION:

Example:

\[ \text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{heat} + \text{light}. \]
OXIDATION REACTION:
Example:
\[ CH_3CH_2OH \xrightarrow{\text{Alk. KMnO}_4 + \text{Heat}} \text{CH}_3\text{COOH} \]
Or
\[ \xrightarrow{\text{Acidified K}_2\text{Cr}_2\text{O}_7 + \text{Heat}} \]

ADDITION REACTION:
Example:
\[ R\backslash\backslash\text{C}=\text{C}\backslash\backslash \xrightarrow{\text{Ni(catalyst)}} \text{H}_2 \quad \text{H} \quad \text{H} \]
\[ \text{R} \quad \text{C} - \text{C} - \text{R} \]
\[ \text{R} \quad \text{R} \]

SUBSTITUTION REACTION:
Example:
\[ \text{CH}_4 + \text{Cl}_2 \xrightarrow{\text{Sunlight}} \text{CH}_3\text{Cl} + \text{HCl} \]

REATIONS OF ETHANOL:
(i) \[ 2\text{C}_2\text{H}_5\text{OH} + 2\text{Na} \rightarrow 2\text{C}_2\text{H}_5\text{ONa} + \text{H}_2\text{O} \]
(ii) \[ \text{C}_2\text{H}_5\text{OH} \xrightarrow{\text{Hot Conc} \ H_2\text{SO}_4} \text{CH}_2 = \text{CH}_2 + \text{H}_2\text{O} \]

REATIONS OF ETHANOIC ACID:
(i) ESTERIFICATION REACTION:
\[ \text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \xrightarrow{\text{Acid}} \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O} \]
(ii) SAPONIFICATION REACTION
\[ \text{CH}_3\text{COOC}_2\text{H}_5 + \text{NaOH (aq)} \rightarrow \text{CH}_3\text{COONa} + \text{C}_2\text{H}_5\text{OH}. \]
(iii) **REACTION WITH BASE**

\[ \text{CH}_3\text{COOH} + \text{NaOH} \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O} \]

(iv) **REACTION WITH CARBONATES AND BICARBONATES**

\[ 2 \text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \rightarrow 2 \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2 \]

\[ \text{CH}_3\text{COOH} + \text{NaHCO}_3 \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2 \]

**CARBON AND ITS COMPOUNDS IN BRIEF**

- Carbon is a versatile non-metal.
- Carbon atom like atoms of other non-metals like oxygen, nitrogen, hydrogen and chlorine shares electrons.
- Carbon forms large number of compounds due to catenation and tetravalency.
- Carbon can form single, double and triple covalent bonds.
- The compounds of hydrogen and carbon are called hydrocarbons, which can be saturated or unsaturated.
- Structurally hydrocarbons can have straight chain, branches or cyclic structure.
- Difference in structural arrangement of same molecule gives rise to isomerism.
- In a hydrocarbon, a heteroatom can replace the hydrogen atom and imparts it chemical properties.
- Homologous series is a series of compounds with same general formula and same chemical properties but different physical properties.
- Carbon based compounds are excellent fuels.
- Ethanol is an important industrial compound. It reacts with reactive metals and is also dehydrated to ethene.
- Ethanoic acid is another important compound. It combines with ethanol to form sweet smelling esters.
- Soaps and detergents are used as cleansing agents. Detergents efficiently cleanses with soft and hard water.
PERIODIC CLASSIFICATION OF ELEMENTS

- Elements: Substances containing atoms of only one type. e.g. Na, Au, Mg etc.
  - There are around 118 elements known to us.
- Elements are classified to make the study easy.

I. Dobereiner’s Triads: When the elements were written in order of increasing atomic masses the atomic mass of the middle was the average of the atomic mass of the other two elements.

<table>
<thead>
<tr>
<th>Elements</th>
<th>Atomic Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca</td>
<td>40.1</td>
</tr>
<tr>
<td>Sr</td>
<td>87.6</td>
</tr>
<tr>
<td>Ba</td>
<td>136.3</td>
</tr>
</tbody>
</table>

- Limitations: Only three triads were recognised from the elements known at that time.

II. Newland’s Law of Octaves

- Based on increasing atomic mass of elements.
- When elements are arranged it was found that every eighth element had properties similar to that of the first. e.g properties of sodium and Lithium are the same.

Limitations

- Applicable only upto Calcium, i.e. for lighter elements.
- Properties of new elements couldn’t fit in it.
- In some cases properties of the elements were not same as defined by octave.
III. Mendeleev’s Periodic Law: The properties of elements are the periodic function of their atomic mass.

Mendeleev’s periodic table based on the chemical properties of elements. It contains vertical columns called groups and horizontal rows called periods.

Achievements of Mendeleev’s Periodic table

– Elements with similar properties could be grouped together
– Some gaps were left for the undiscovered elements.
– Noble gases could be placed without disturbing the existing order.

Limitations

– No fixed position for hydrogen
– No place for isotopes
– No regular trend in atomic mass.

IV. Modern Periodic Table

Modern Periodic Law: Properties of elements are a periodic function of their atomic number.

– Atomic Number – denoted by Z and equals to the no. of protons in the nucleus of an atom.
– Modern periodic table contains 18 vertical columns known as groups and 7 horizontal rows known as periods.
– Elements in a group have the same number of valence electrons
– No. of the shells increases as we go down the group.
– Elements in a period have same number of shells.
– Each period marks a new electronic shell getting filled.
– No. of elements placed in a particular period depends upon the fact that how electrons are filled into various shells.
– Maximum no. of electrons that can be accommodated in a shell depend on the formula $2n^2$ where $n$ is the no. of the given shell.

  e.g. K shell – $2 \times (1)^2 = 2$ elements in the first period
  L shell – $2 \times (2)^2 = 8$ elements in the second period.
– Position of the element in the periodic table tells about its reactivity.
Trends in the Modern Periodic Table

- **VALENCY** : No. of valence electrons present in the outermost shells. Valency remains the same down a group but changes across a period.

- **ATOMIC SIZE** : Atomic size refers to radius of an atom.

- Atomic size or radius decreases in moving from left to right along a period.

- Atomic size increases down the group because new shells are being added as we go down the group.

**METALLIC CHARACTER** : Metallic character means the tendency of an atom to lose electrons.

- Metallic character decreases across a period because the effective nuclear charge increases that means the tendency to lose electrons decreases.

- Metals are electropositive as they tend to lose electrons while forming bonds.

- Metallic character increases as we go down a group as the effective nuclear charge is decreasing. Non metals are electronegative. They tend to form bonds by gaining electrons.

- Metals are found on the left side of the period table while non-metals are towards the right hand side of the periodic table.

- In the middle we have semi-metals or metalloid because they exhibit some properties of both metals and non metals.

- Oxides of metals are basic in nature while oxides of non-metals are acidic in nature.

(Refer the table given on side page)

Gradation in Periodic Properties

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Property</th>
<th>Variation across period</th>
<th>Reason</th>
<th>Variation along group</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Atomic size</td>
<td>Decreases</td>
<td>Due to increase in nuclear charge, or resulting in stronger force of attraction which cause shrinking.</td>
<td>Increases</td>
<td>Due to addition of new shells, the distance between outer most electron and nucleus increases.</td>
</tr>
<tr>
<td>S. No.</td>
<td>Property</td>
<td>Variation across period</td>
<td>Reason</td>
<td>Variation along group</td>
<td>Reason</td>
</tr>
<tr>
<td>-------</td>
<td>------------------------</td>
<td>--------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-----------------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2.</td>
<td>Metallic Character</td>
<td>Decreases</td>
<td>Due to increase in effective nuclear charge, tendency to lose valence electrons decreases.</td>
<td>Increases</td>
<td>Decrease in effective nuclear charge experienced by valence electrons Tendency to lose electrons (metallic character) increases.</td>
</tr>
<tr>
<td>3.</td>
<td>Non-metallic Character (electronegativity)</td>
<td>Increases</td>
<td>Due to increase in effective nuclear charge tendency to gain electrons increases</td>
<td>Decreases</td>
<td>Due to decrease in effective nuclear charge experienced by valence electron (due to addition of new shell), tendency to gain electrons decreases.</td>
</tr>
</tbody>
</table>

(QUESTION BANK)

**VERY SHORT ANSWER TYPE QUESTIONS (1 MARK)**

1. Write down three elements which represent Dobereiner’s triad.
2. Write down two drawbacks of Newland’s law of octaves.
3. Which important property did Mendeleev used to classify the elements in his periodic table.
4. Explain why the number of elements in the third period is 8?
5. Name two elements you would expect to show chemical reactions similar to lithium.
6. Define Isotopes.
7. What was the need for classification of elements?
8. Name two elements that have only two electrons in their outermost shell.
9. How many vertical columns and horizontal rows are there in modern periodic table, What is the special name assigned to them?
10. Name the element having electronic configuration 2, 8, 3. What is its Valency?
**SHORT ANSWER TYPE QUESTIONS (2 MARKS)**

1. Why He, Ne and Ar are called inert gases?
2. Which one has greater atomic size – Cl or Br? Why?
3. What were the drawbacks of Mendeleev’s periodic table? Write any two.
4. How does the tendency to lose electrons change in a group and why?
5. Justify the statement – Atomic size of an element decreases along a period whereas increases down the group.
6. What is the metallic character of an element? How does it vary as we go down a group? Give reason for this variation.
7. How does electronegativity of an element change as you go down a group and across a period? Give reason for the variation.

**LONG ANSWER TYPE QUESTIONS (3 MARKS)**

1. How do we calculate the valency of an element from its electronic configuration?
   - How does the valency vary in a period?
   - How does the valency vary in going down a group?
2. Study the variation in the atomic radii of elements given below and arrange them in an increasing order

<table>
<thead>
<tr>
<th>Element</th>
<th>Radii (pm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na</td>
<td>186</td>
</tr>
<tr>
<td>Li</td>
<td>152</td>
</tr>
<tr>
<td>Rb</td>
<td>246</td>
</tr>
<tr>
<td>Cs</td>
<td>262</td>
</tr>
<tr>
<td>K</td>
<td>231</td>
</tr>
</tbody>
</table>

   (ii) Name the element which has the smallest and the largest atoms.
   (iii) How does the atomic size vary as we go down a group. Give reason for your answer.
3. Four elements ABCD along with their electronic configurations are given below

<table>
<thead>
<tr>
<th>Elements</th>
<th>-</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic Configuration</td>
<td>2, 1</td>
<td>2, 8</td>
<td>2, 8, 1</td>
<td>2, 8, 8</td>
<td></td>
</tr>
</tbody>
</table>

   Now answer the following questions:
4. Why did Mendeleev choose formulae of compounds as the basis for deciding the position of an element in his table? Why did he leave some gaps in his periodic table? Name two elements which were discovered later but filled in the gaps left by Mendeleev.

(a) Which two elements belong to the same period.
(b) Which two elements belong to the same group
(c) Which element out of A and C is more reactive and why?

**LONG ANSWER TYPE QUESTIONS (5 MARKS)**

1. Write down five major differences between Mendeleev periodic table and modern periodic table.

2. Examine elements of the third period and classify them as metals and non-metals.

   (ii) On which side of the table do you find metals and why.

   (iii) On which side of the table do you find the non-metals and why?
CHAPTER - 8

HOW DO ORGANISM REPRODUCE

- Reproduction is the process by which living organisms produce new individuals similar to themselves.
- Reproduction ensures continuity of life on earth.
- It involves continuation of characters from the parents to daughter cells [by **Copying of DNA** (Deoxyribose Nucleic Acid) molecules present in the chromosomes of the cell].
- Copying of DNAs is also not a foolproof exercise, even minute changes bring about **Variation** in the blue print of the offsprings.
- Variations help the species to withstand drastic environmental changes, thus save the species from becoming extinct and promotes its survival for a longer time.

### REPRODUCTION

<table>
<thead>
<tr>
<th>Asexual Reproduction</th>
<th>Sexual Reproduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A single parent is involved</td>
<td>1. Both Parents involved</td>
</tr>
<tr>
<td>2. Gametes not formed</td>
<td>2. Gametes are formed</td>
</tr>
<tr>
<td>3. Progeny is Identical to parent e.g. Fission in Amoeba</td>
<td>3. Progeny is only genetically similar to the parent but not identical</td>
</tr>
</tbody>
</table>

- Asexual Reproduction is extremely useful as a mean of rapid multiplication. It is common in lower plants and animals.

### MODES OF ASEXUAL REPRODUCTION

1. **FISSION**: the parent cell divides/splits into two daughter cell- Binary Fission; splits into many cells-multiple Fission.
2. **BUDDING** : A bud develops as an outgrowth on parent body due to repeated cell division at a specific site. These buds detach from the parent body when they mature. *E.g.* Hydra, yeast.

3. **SPORE FORMATION** : Spores are small, bulb like structure which are covered by thick walls that protect them until they come in contact with suitable condition. Under favourable conditions, they germinate and produce new organism.
4. **FRAGMENTATION**: It is the accidental process when the broken pieces of an organism (fragments) grows into a complete organism.

   Eg. fragmentation in spirogyra

5. **REGENERATION**: When the simple animals like Hydra Planaria develop a new individual from their broken older part it is known as regeneration. It is carried out by specialised cells which divide and differentiate to form the complete individual.

   New individuals (Planaria) regenerate from their broken older parts

   New individuals (Hydra) regenerate from their broken older parts
Vegetative Propagation

A mode of reproduction in which reproduction takes place from the vegetative parts like the stem, root, leaves.

Methods of Vegetative Propagation

Natural

1. By Roots : E.g. adventitious roots of Dahlias
2. By Stems : E.g. Potato (tuber), ginger (rhizome)
3. By Leaves : E.g. leaves of bryophyllum bear adventitious buds (in the notches of leaf margin) which develop into new plants.

Artificial

2. Cutting : E.g. Rose
3. Layering : E.g. Jasmine

Benefits of Vegetative Propagation

1. Plants can bear flowers, fruits earlier than those produced from seeds.
2. Growing plants like Banana, orange, rose, jasmine that have lost the capacity to produce seeds.
3. Genetical similarity is maintained in the plants.
4. Helps in growing seedless fruits.
5. Cheaper and easier method of growing plants.

Sexual Reproduction

When reproduction takes place as a result of fusion of two gametes, one from each parent, it is called sexual reproduction.

- The process of fusion of male and female gametes is called fertilization.
- The formation of gamets involves exchange of chromosomal (genetic) fragments between homologous chromosomes causing genetic recombination which leads to variation.
Sexual Reproduction in Plants

It occurs mostly in flowering plants. In fact flowers are the reproductive organ of plants.

FLOWERS

Bisexual Flowers
Both male and female reproductive part i.e., stamen & carpel are present.
Eg. Hibiscus, mustard

Unisexual Flowers
Either male or female reproductive part is present.
Eg. Papaya, Watermelon

A typical flower consists of four main whorls namely calyx (sepals), Corolla (Petals), Androecium (Stamens) and Gynoecium (Carpels).
Reproductive Part of Flower

STAMEN (male part)

Filament  Anther (2n)  meiosis

CARPEL (Female part)

STYLE  OVARY  STIGMA (2n)  meiosis

POLLEN GRAIN (MALE GAMETE) (n)

- Pollen grains of a flower transfer to the stigma of the carpel of the same flower (Self-Pollination) or to the stigma of carpel of the another flower (Cross-Pollination).
- This transfer of pollens is achieved by agent like wind, water or animals.
- After Pollination, a pollen tube grows out of pollen grains, through which male germ cell reaches the ovary and fuses with the female germ cell.
- Fertilization: The fusion of male and female gamete is called fertilization. It occurs inside the ovary. Zygote is produced in this process.
- Zygote divides several times to form an embryo within the ovule. The ovule develops a tough coat and is converted into a seed.

- Ovary grows rapidly and ripens to form a fruit, while the seed contains the future plant or embryo which develops into a seedling under suitable conditions. This process is known as Germination.

**Reproduction in Human Beings**

- Humans use a Sexual Mode of reproduction.

- It needs ***sexual maturation*** which includes the creation of germ cells i.e., eggs (ova) in the female and sperm in the male partner, and this period of sexual maturation is called **Puberty**.

**Male Reproductive System**

- The formation of male germ cells (sperms) takes place in the testes (male reproductive organ).

- A pair of testes are located inside the scrotum, which is present outside the abdominal cavity. Scrotum has a relatively low temperature needed for the production of sperm by testes.

- Testes release a male sex hormone called **testosterone** and its function is to:
  1. Regulate the production of sperm
  2. Bring about changes in appearance seen in boys at the time of puberty.

- The sperms along with the secretion of the prostate gland and seminal vesicle, together constitute semen, which is released and made to enter into the female genital tract during **Copulation**.

**Female Reproductive System**

- The female germ cells or eggs are produced in the ovaries. Located in both sides of the abdomen.

- When a girl is born, the ovaries already contain thousands of immature eggs.

- At puberty, some of these eggs start maturing. One egg is produced every month by one of the ovaries.
The Egg is carried from the ovary to the womb through a fallopian tube. These two fallopian tube unite into an elastic bag like structure known as uterus.

- The Uterus opens into the vagina through the cervix.
- Fertilization occurs in the fallopian tube of female genital tract.
- The fertilized egg also called zygote (2n) gets implanted in the lining of the uterus, and start dividing. Actually uterus is richly supplied with blood to nourish the growing embryo. If zygote is not formed, the inner wall of uterus breaks which causes bleeding through vagina. This process is called MENSTRUATION. It occurs at a regular interval of 28 days.
- The Embryo gets nutrition from the mother’s blood with the help of a special tissue called PLACENTA. It provides a large surface area for glucose and oxygen to pass from the mother to the embryo. Similarly the wastes from developing embryo are removed to mother’s blood through placenta.
- The time period from fertilization upto the birth of the baby is called Gestation Period. In humans, it is about nine months (36 weeks).
- The sexual cycle (Menstruation) in a woman continues upto the age of 45-50 years. After that the ovaries do not release egg. This stage is called Menopause. It also marks the end of the reproductive life of a woman.
- Female sex hormones are oestrogen and progesterone which are produced by ovary.
Reproductive Health

- Reproductive Health means a total well-being in all aspects of reproductive, *i.e.*, physical emotional, social and behavioural.
- **Contraception**: It is the avoidance of pregnancy. It can be achieved by preventing the fertilization of ova.
METHODS OF CONTRACEPTION

- PHYSICAL BARRIER
  To prevent union of sperm & egg. Use of condoms, Diaphragm & cervical caps.

- SURGICAL METHOD
  Also called sterilization in Vasectomy, the vas deferens of male is blocked to prevent sperm transfer.
  In Tubectomy, the fallopian tube of female is blocked to prevent egg to reach uterus.

- CHEMICAL METHOD
  Oral contraceptive (OCs) - changes the hormonal balance to check the egg release in females. OCs cause side effect.

- IUCD
  Intrauterine contraceptive device Copper-T or loop is placed in uterus to prevent pregnancy.

- Healthy society needs a balanced sex ratio that can be achieved by educating people to avoid malpractices like female foeticide & prenatal sex determination.

SEXUALLY TRANSMITTED DISEASES (STDs)
The diseases which spread by sexual contact with an infected person are called sexually transmitted disease (STD)

- VIRAL
  eg. HIV-AIDS, WARTS

- BACTERIAL
  eg. Syphilis and Gonorrhoea.

QUESTION BANK

(1 MARK)

1. Where is the DNA present in the cell?
2. What is a bisexual flower? Give one example.
3. Write suitable condition necessary for seed germination.
4. Write the function of the secretions of seminal vesicle and prostate gland.
5. Name the part of female reproductive system where the egg is fertilized.
6. How does the chemical method help in preventing pregnancy?

7. Name the floral parts of a plant that develop into
   (i) Fruit  (ii) Seeds

8. What method will you use for growing Jasmine and Rose (plants)?

9. Name the hormones responsible for secondary sexual characters in
   (i) Girls  (ii) Boys.

10. What is Gestation period?

   **(2 MARKS)**

   1. What is the importance of DNA copying in reproduction.
   2. Write any two differences between sexual and asexual reproduction.
   3. Why is vegetative propagation practised for growing some types of plants?
   4. Distinguish between male & female gamete.
   5. Write two important functions of testosterone.
   6. What is placenta? Also write its two functions.
   7. Explain regeneration.
   8. With the help of flow diagram trace the path of sperm from the site of its formation to outside the body of males.
   9. What is tissue culture in plants?
   10. State the role of reproduction in providing stability to populations of various species.

   **(3 MARKS)**

   1. Draw a well labelled diagram of human female reproductive system. Explain the menstrual cycle of female.
   2. Draw a labelled diagram to explain fertilization in higher plant.
3. (i) Give two reasons for avoiding frequent pregnancies by women.
(ii) Explain the following methods of contraception giving one example of each.
   (a) Barrier method.        (b) Surgical method.

4. In human females, what happens when
   (i) egg is fertilised
   (ii) egg is not fertilised?

5. Give two examples each of sexually transmitted diseases (STDs) caused by (i) Virus; (ii) bacteria.

(5 MARKS)

1. Trace and explain the steps involved in the formation of seed starting from pollination.

2. List any four modes of asexual reproduction. Give one example of each.
   Explain any two modes of asexual reproduction.


CHAPTER – 9

HEREDITY AND EVOLUTION

- Genetics: Branch of science that deals with Heredity and variation.

- Heredity: It means the transmission of features/characters/trait from one generation to the next generation.

- Variation: The differences among the individuals of a species/population are called variations.

Mendel and His Work on Inheritance

- Gregor Johann Mendel (1822 & 1884): Started his experiments on plant breeding and hybridisation. He proposed the laws of inheritance in living organisms.

  Mendel → was known as Father of Genetics

- Plant selected by Mendel: Pisum sativum (garden pea). Mendel used a number of contrasting characters for garden pea.

<table>
<thead>
<tr>
<th>TABLE OF CONTRASTING CHARACTERS. SEVEN PARTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHARACTER</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Flower colour</td>
</tr>
<tr>
<td>Flower position</td>
</tr>
<tr>
<td>Seed colour</td>
</tr>
<tr>
<td>Seed shape</td>
</tr>
<tr>
<td>Pod shape</td>
</tr>
<tr>
<td>Pod colour</td>
</tr>
<tr>
<td>Height of plant</td>
</tr>
</tbody>
</table>

Seven pairs of contrasting characters in Garden Pea.
Mendel's Experiments: Mendel conducted a series of experiments in which he crossed the pollinated plants to study one character (at a time).

Monohybrid Cross

Cross between two pea plants with one pair of contrasting characters is called a monohybrid cross.

Example: Cross between a tall and a draft plant (short).

**MONOHYBRID CROSS**

<table>
<thead>
<tr>
<th>PARENT</th>
<th>Tall plant</th>
<th>Dwarf plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALLELIC PAIR OF GENES</td>
<td>TT × tt</td>
<td>Tt × Tt</td>
</tr>
<tr>
<td>GAMETES</td>
<td>T T</td>
<td>t t</td>
</tr>
<tr>
<td>F₁ GENERATION (first filial generation)</td>
<td>All tall plants</td>
<td></td>
</tr>
</tbody>
</table>

| SELF POLLINATION of F₁ gametes | Gametes
|---------------------------------| T t
| F₂ GENERATION | TT Tt
tall tall
tall
dwarf

Phenotypic ratio 3:1
Genotypic ratio 1:2:1
<table>
<thead>
<tr>
<th>CHARACTER</th>
<th>DOMINANT TRAIT</th>
<th>RECESSIVE TRAIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed shape</td>
<td>Round</td>
<td>Wrinkled</td>
</tr>
<tr>
<td>Seed colour</td>
<td>Yellow</td>
<td>Green</td>
</tr>
<tr>
<td>Flower colour</td>
<td>Violet</td>
<td>White</td>
</tr>
<tr>
<td>Pod shape</td>
<td>inflated/full</td>
<td>Constricted</td>
</tr>
<tr>
<td>Pod colour</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flower position</td>
<td>Green</td>
<td>Yellow</td>
</tr>
<tr>
<td>Stem height</td>
<td>Axial</td>
<td>Terminal</td>
</tr>
<tr>
<td></td>
<td>Tall</td>
<td>Dwarf</td>
</tr>
</tbody>
</table>
### Observations of Monohybrid Cross

1. All F1 progeny were tall (no medium height plant (half way characteristic))
2. F2 progeny ¼ were short, ¾ were tall
3. Phenotypic ratio F2 – 3:1 (3 tall : 1 short)

   Genotypic ratio F2 – 1:2:1 \[ \left( \frac{TT}{1} : \frac{Tt}{2} : \frac{tt}{1} \right) \]

### Conclusions

1. TT and Tt both are tall plants while tt is a short plant.
2. A single copy of T is enough to make the plant tall, while both copies have to be ‘t’ for the plant to be short.
3. Characters/Traits like 'T' are called dominant trait (because it express itself) and ‘t’ are recessive trait (because it remains suppressed)

**Dihybrid Cross** : A cross between two plants having two pairs of contrasting characters is called dihybrid cross.
**PARENT GENERATION** → **ROUND GREEN SEEDS × WRINKLED YELLOW SEEDS**

**GAMETES**

**F₁** → **RrYy [round, yellow]**

**Phenotypic Ratio**

<table>
<thead>
<tr>
<th></th>
<th>RY</th>
<th>Ry</th>
<th>rY</th>
<th>ry</th>
</tr>
</thead>
<tbody>
<tr>
<td>O→</td>
<td>RY</td>
<td>RY</td>
<td>RY</td>
<td>RY</td>
</tr>
<tr>
<td></td>
<td>RRY</td>
<td>RRYy</td>
<td>RryY</td>
<td>Rryy</td>
</tr>
</tbody>
</table>

**Observations**

1. When **RRyy** was crossed with **rrYY** in F₁ generation all were Rr Yy round and yellow seeds.
2. Self pollination of $F_1$ plants gave parental phenotype and two mixtures (recombinants round yellow & wrinkled green) seeds plants in the ratio of $9:3:3:1$

\[
\begin{align*}
\text{Round} : \text{Round} : \text{Wrinkled} : \text{Wrinkled} \\
\text{Yellow} : \text{green} : \text{yellow} : \text{green}
\end{align*}
\]

Conclusions
1. Round and yellow seeds are **DOMINANT** characters
2. Occurrence of new phenotypic combinations show that genes for round and yellow seeds are **inherited independently** of each other.

**SEX DETERMINATION**

Determination of sex of an offspring.

**FACTORS Responsible for Sex Determination**

- **Environmental**
  - In some animals the temperature at which the fertilised eggs are kept decides the gender.
  - eg. in Turtle

- **Genetic**
  - In some animals like humans gender or individual is determined by a pair of chromosome called sex chromosome
  - $XX$ – Female
  - $XY$ – Male

**Sex Chromosomes**: In human beings there are 23 pairs of chromosome. Out of these 22 chromosomes pairs are called autosomes and the last pair of chromosome that help in deciding gender of that individual is called sex chromosome.

- $XX$ – female
- $XY$ – male
Sex determination in Human beings

PARENTS:
FATHER: XY
MOTHER: XX

GAMETES (Reproductive cells)

Zygote formed after fusion of gametes

offspring

50% probability of a female child

50% probability of a male child

This shows that half the children will be boys and half will be girls. All children will inherit an X chromosome from their mother regardless whether they are boys or girls. Thus sex of children will be determined by what they inherit from their father, and not from their mother.

EVOLUTION

Evolution is the sequence of gradual changes which takes place in the primitive organisms, over millions of years, in which new species are produced.

Situation-I

Group of red beetles

Colour variation arises during reproduction

All beetles red except one that is green

Crows feed on red beetle

No. of beetles reduces

One beetle Green

Reproduction

Progeny beetles green

[Class X : Science]
Crow could not feed on green beetles as they got camouflaged in green bushes
Number of green beetles increases

**Situation 1**: Green beetles got the survival advantage or they were naturally selected as they were not visible in green bushes. This natural selection is exerted by crows resulting in adaptations in the beetles to fit better in their environment.

**Situation-II**

```
Group of red beetles
  ↓ Reproduction

All beetles are red except one
  ↓ that is blue
  ↓ Reproduces

Number of red beetle increases
  ↓ Crows can see both blue and red beetles and can eat them
  ↓ Number reduces but still red beetles are more and blue ones are few
  ↓ Suddenly elephant comes and stamps on the bushes
  ↓ Now beetles left are mostly blue.
```

**Situation 2**: Blue beetles did not get survivals advantage. Elephant suddenly caused major havoc in beetle population otherwise their number would have been considerably large.

From this we can conclude that accidents can change the frequency of some genes even if they do not get survival advantage: This is called genetic drift and it leads to variation.
**Situation-III**

Group of red beetles

Habitat of beetles (bushes)
Suffer from plant disease

Average weight of beetles decreases due to poor nourishment

Number of beetles kept on reducing

Later plant disease gets eliminated

Number and average weight of the beetles increases again

**Situation 3:** No genetic change has occurred in the population of beetle. The population gets affected for a short duration only due to environmental changes.

**Acquired and Inherited Traits**

<table>
<thead>
<tr>
<th>Acquired Traits</th>
<th>Inherited Traits</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. These are the traits which are</td>
<td>1. These are the traits which are</td>
</tr>
<tr>
<td>developed in an individual due</td>
<td>passed from one generation to</td>
</tr>
<tr>
<td>to special conditions</td>
<td>the next.</td>
</tr>
<tr>
<td>2. They cannot be transferred to the progeny</td>
<td>2. They get transferred to the progeny.</td>
</tr>
<tr>
<td>3. They cannot direct evolution</td>
<td>3. They are helpful in evolution.</td>
</tr>
<tr>
<td>eg. Low weight of starving</td>
<td>eg. Colour of eyes and hair</td>
</tr>
<tr>
<td>beetles.</td>
<td></td>
</tr>
</tbody>
</table>
SPECIATION

**Micro Evolution**: It is the evolution which is on a small scale. e.g. change in body colour of beetles.

The process by which new species develop from the existing species is known as speciation.

**Speciation**: it is the process of formation of new species.

**Species**: A group of similar individuals within a population that can interbreed and produce fertile offspring.

**Geneflow**: It is exchange of genetic material by interbreeding between populations of same species or individuals

WAYS BY WHICH SPECIATION TAKES PLACE

Speciation takes place when variation is combined with geographical isolation.

**Gene flow**: occurs between population that are partly but not completely separated.

GENETIC DRIFT

It is the random change in the frequency of alleles (gene pair) in a population over successive generations.

*Natural Selection*: The process by which nature selects and consolidate those organisms which are more suitably adapted and possesses favorable variations
POPULATION Z

Sub Population $Z_1$  
GEOGRAPHICAL BARRIER  
ISOLATION  
(River, Mountain)  
Sub Population $Z_2$

Over many-many generations

Results in Accumulation of different variations in Sub population $Z_1$ and $Z_2$

Genetic drift

Natural selection

Sub population $Z_1$ and $Z_2$ incapable of interbreeding

Reproductive Barrier

Formation of new Species 1  
Formation of new Species 2

Genetic drift takes place due to:

(a) Severe changes in the DNA

(b) Change in number of chromosomes

Evolution and Classification

Both evolution and classification are interlinked.

1. Classification of species is reflection of their evolutionary relationship.

2. The more characteristic two species have in common the more closely they are related.
3. The more closely they are related, the more recently they have a common ancestor.

4. Similarities among organisms allow us to group them together and to study their characteristic.

TRACING EVOLUTIONARY RELATIONSHIPS
(Evidences of Evolution)

1. **Homologous Organs** : (Morphological and anatomical evidences). These are the organs that have same basic structural plan and origin but different functions.

Homologous organs provides evidence for evolution by telling us that they are derived from the same ancestor.
Example:
Forelimb of Horse (Running) | Same basic structural plan, but different functions perform.
Winds of bat (flying)      
Paw of a cat (walk/scratch/attack)  

II. Analogous Organs: These are the organs that have different origin and structural plan but same function example:

Example: Analogous organs provide mechanism for evolution.
Wings of bat → elongated fingers with skin folds | Different basic structure, but perform similar function i.e., flight.
Wings of bird → Feathery covering along the arm

III. Fossils: (Paleontological evidences)
The remains and relics of dead organisms of the past.

FOSSILS ARE PRESERVED TRACES OF LIVING ORGANISMS

Fossil Archaeopteryx possess features of reptiles as well as birds. This suggests that birds have evolved from reptiles.

Examples of Fossils
AMMONITE - Fossil-invertebrate
TRILOBITE - Fossil-invertebrate
KNIGHTIA - Fossil-fish
RAJASAUROUS - Fossil dinosaur skull

AGE OF THE FOSSILS

I. Deeper the fossil, older it is.
II. Detecting the ratios of difference of the same element in the fossil material i.e. Radio-carbon dating [C-(14) dating]

1. (Top Layer of earth surface)
2. 
3. 
4. 
5. 
6. Older

Recent
Evolution by Stages

Evolution takes place in stages ie bit by bit over generations.

I. Fitness Advantage

Evolution of Eyes: Evolution of complex organs is not sudden it occurs due to minor changes in DNA, however takes place bit by bit over generations.

→ Flat worm has rudimentary eyes enough to give fitness advantage

→ Insects have compound eyes

→ Humans have binocular eyes

II. Functional Advantage

Evolutions of Feathers

Feathers → provide insulation in cold weather but later they might become useful for flight.

Example: Dinosaurs had feathers, but could not fly using feathers. Birds seem to have later adapted the feathers to flight.
Evolution by Artificial Selection: Humans have been a powerful agent in modifying wild species to suit their own requirement throughout ages by using artificial selection. E.g. (i) From wild cabbage many varieties like broccoli, cauliflower, red cabbage, kale, cabbage and kohlrabi were obtained by artificial selection. (ii) Wheat (many varieties obtained due to artificial selection).

Molecular Phylogeny

- It is based on the idea that changes in DNA during reproduction are the basic events in evolution.
- Organisms which are more distantly related will accumulate greater differences in their DNA.

HUMAN EVOLUTION

Tools to Study Human Evolutionary Relationship

- Excavating
- Time dating
- Fossils
- Determining DNA Sequences

Although there is great diversity of human forms all over the world get all humans are a single species.

GENETIC FOOTPRINTS OF HUMANS

Hundreds/thousand of years ago

Earliest members arose in Africa

- East Asia
- South Africa
- Africa
- Island of Indonesia
- West Asia
- Central Asia
- Australia
- Eurasia

Philippines

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● They did not go in a single line
● They went forward and backward
● Moved in and out of Africa
● Sometimes came back to mix with each other.

**QUESTION BANK**

**Very Short Answers** (1 Mark)

1. Define variation
2. What is monohybrid cross?
3. What are genes?
4. If an individual has XX chromosome \([22 + XX]\) will that individual be male or female.
5. Which plant Mendel had chosen for his experiments.
6. Name the branch of science that deals with Heredity and variation.
7. Name two human traits which show variation.
8. What will you get in \(F_1\) generation when a pea plant having violet coloured flowers is crossed with white coloured flowers? Give reason.
9. Who is the father of Genetics?
10. Write the scientific name of men and garden pea.
11. Where can be the Genetic footprint of human be traced?

**Short Answers** (2 Marks)

1. Differentiate between acquired and Inherited traits? Give example of each.
2. What are fossils? How can the age of fossils be determined.
3. What is speciation? What factors lead to formation of a new species.

4. Explain the mechanism of sex determination in humans.

5. Differentiate between homologous and analogous organs by giving examples.

6. Define inheritance. What are the units of inheritance.

7. What is genetic drift? How does it contribute to the formation of new species.

8. Explain monohyrid cross by taking tall and dwarf plants. Mention the phenotypic and genotypic ratio of F1 and F2 off springs.

9. How does creation of variations in a species promote survival?

10. Why did Mendel select pea plants for conducting his experiments on inheritance?

11. Why is the father responsible for the sex of a child?

12. Why are acquired traits not passed on to their progeny?

**Short Answer**

1. Describe any three ways in which individuals with a particular trait may increase in a population.

2. Name two fossils. What do fossil tells us about the process of evolution?

3. What are the important sources which provide evidence for evolution? Explain them with example.

**Long Answer**

1. Explain the process of artificial selection by taking the example of wild cabbage plant.

2. Explain human evolution.

3. What are dominant and recessive traits? How do mendel’s experiment show that traits may be dominant or recessive? Explain with an example.

4. How do mendel’s experiments show that traits are inherited independently? Explain with a Dihybrid cross.
5. A purple coloured flower is crossed with a plant having white coloured flower. In $F_1$ generation all plants obtained contained purple flowers. Draw a cross and mention the genotypic and phenotypic ratio. What will happen in $F_2$ generation if $F_1$ plants are selfed.
CHAPTER - 10

LIGHT REFLECTION & REFRACTION

Light is a form of energy, which enable us to see the object.

Nature of Light

1. It is an electromagnetic wave and do not require any medium for their propagation.
2. Wavelength of visible light (VIBGYOR) is very small i.e. $4 \times 10^{-7}$ m to $8 \times 10^{-7}$ m.
3. Speed of light is very high i.e. $3 \times 10^8$ m/s in vacuum.
4. It is composed of particles, which travels in a straight line.

Reflection of Light

When the light is allowed to fall on highly polished surface, such as mirror, most of the light gets reflected in the same medium.

Laws of Reflection

![Diagram of Reflection](image)

First Law
Angle of incidence = Angle of reflection

$\angle i = \angle r$

Second Law
The incident ray, reflected ray and normal at the point of incidence, of the reflecting surface lie in the same plane.
ADVANTAGES OF REFLECTION OF LIGHT

(1) We can read our book, due to reflection of sunlight or bulb light that falls on our eye after falling on book.

(2) We can see only those things around us that reflect the light falling on it by any source of light.

Image formed by Plane Mirror (Plane reflecting surface)

1. Virtual (imaginary) & Erect (⇒ The image that do not form on screen.)
2. Laterally inverted (The left side of object appear on right side of image)
3. The size of image is equal to that of object.
4. The image formed is as far behind the mirror as the object is in front of it.

Reflection of light by spherical Mirrors

Mirrors, whose reflecting surface are curved inward or outward spherically are called spherical mirror.

For example - Spoon } → The curved surface of shining spoon can be considered as curved mirror.
If it is curved inward → Act as concave mirror
If it is curved outward → Act as a convex mirror.

**Few Basic terms related to Spherical Mirror**

1. **Principal axis** : Line joining the pole and centre of curvature of the spherical mirror.

2. **Pole** : The geometrical central point of the reflecting spherical surface. (aperture), denoted by (P).

3. **Aperture** : The width of reflecting spherical surface.

4. **Centre of curvature** : The centre of the hollow glass sphere of which the spherical mirror is a part is called as centre of curvature.

5. **Radius of curvature** : The distance between the pole and the centre of curvature, i.e. $PC = R$ or The radius of the hollow sphere of which the mirror is a part.

6. **Focus point** : The point on the principal axis, where all parallel rays meet after reflection is called as Principal Focus or Focus. It is denoted by letter ‘F’.

7. **Focal length** : The distance between the pole and focus point i.e. $PF = f$
8. Relationship between focal length and Radius of curvature.

\[ F = \frac{R}{2} \]

IMPORTANT TIPS TO DRAW RAY DIAGRAM (SPHERICAL MIRROR)

(a) Remember, a ray of light which is parallel to principle axis always pass through focus (meet at focus) or vice-versa.

(b) A ray of light which passes through centre of curvature (it is also known as normal at the point of incidence on spherical mirror) will retrace their path after reflection.
(c) A ray of light falling on pole get reflected at the same angle on the other side of principal axis.

HOW TO DRAW ANGLE OF INCIDENCE AND ANGLE OF REFLECTION FOR SPHERICAL MIRROR

By drawing the normal at the point of incidence (i.e. the ray that passes through centre of curvature ‘C’) we would be able to draw angle of incidence and reflection.
REAL AND VIRTUAL IMAGE

(1) The image which can be obtained on a screen is called a real image.

(2) The image which cannot be obtained on a screen is called a virtual image.

IMAGE FORMATION BY CONCAVE MIRROR

<table>
<thead>
<tr>
<th>(1)</th>
<th>Object Position</th>
<th>Image Position</th>
<th>Size of Image</th>
<th>Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At infinity</td>
<td>At focus ‘F’</td>
<td>Highly diminished (point size)</td>
<td>Real and inverted</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(2)</th>
<th>Object Position</th>
<th>Image Position</th>
<th>Size of Image</th>
<th>Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Beyond ‘C’</td>
<td>Between ‘F’ &amp; ‘C’</td>
<td>Small</td>
<td>Real &amp; inverted</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At ‘C’</td>
<td>At ‘C’</td>
<td>Same size of object</td>
<td>Real &amp; Inverted</td>
</tr>
</tbody>
</table>
AFTER OBSERVING ABOVE FIVE DIAGRAMS, WE CONCLUDE THAT-

When object moves towards ‘F’
Image moves towards infinity

We have five position in common i.e. 1. At focus ‘F’, 2. Between ‘F’ and ‘C’, 3. At ‘C’, 4. Beyond ‘C’, and 5. at infinity where object is placed and image is formed.

But we observed that when object is shift towards focus ‘F’ from infinity, the image formation will shift towards infinity from focus and size of image increases.
Image Formation by Convex Mirror

1. Object position
   - Between F & P
2. Image Position
   - Behind the mirror
3. Size of image
   - Enlarged
4. Nature
   - Virtual & erect

Uses of Concave Mirror

(1) Used in torches, search light and headlight of vehicles because when a lighted bulb is placed at the focus of concave reflector, the light will be reflected as strong parallel ray and therefore helps in viewing the considerable distance in the night.
(2) Used to see large image of face because when the face is held within the focal length of a concave mirror, an enlarged image of face is seen. (Refer diagram 6 of page 120)

(3) Used by the dentist to see large image of teeth, so that defect can be easily detected.

(4) Used to focus sunlight in solar furnace. The furnace is kept at the focus of concave mirror. When parallel beam of light from the sun falls on mirror are reflected back to meet at focus. (Refer page 119, diagram)

USES OF CONVEX MIRROR

(1) Convex mirror always produces erect image and the image form is highly diminished, due to which is gives a wide field of view (of the traffic behind)

(2) Used as shop security mirror.

TO APPLY SIGN CONVENTION

INITIAL STEPS

Object should be always placed to the left side of mirror

All distances should be measured from Pole ‘P’

According to graphical representation take ‘P’ as origm ‘O’ and then apply Cartesian system.
For Example

In this Diagram

1. Object Distance ‘u’ is Negative (-X Axis)
2. Image Distance ‘V’ is Negative (-X Axis)
3. Height of the object ‘h’ is Positive (+Y Axis)
4. Height of the image ‘h₂’ is Negative (-Y Axis)
5. Focal length ‘F’ is Negative (-X Axis)
6. Radius of Curvature ‘R’ is Negative (-x Axis)

Mirror Formula

\[ \frac{1}{f} = \frac{1}{v} + \frac{1}{u} \]

where

\[ f = \frac{R}{2} \]

\[ f \rightarrow \text{distance between F and Pole} \]

\[ v \rightarrow \text{distance of image from Pole} \]

\[ u \rightarrow \text{distance of object from Pole} \]

\[ R \rightarrow \text{distance between centre of curvature and pole.} \]
Magnification

It is expressed as the ratio of the height of the image to height of the object.

\[
m = \frac{\text{height of image}}{\text{height of object}} = \frac{h_2}{h_1} \quad (1)
\]

It is also related to ‘u’ and ‘v’

\[
m = \frac{-v}{u} \quad (2)
\]

∴ from 1 and 2 equation

\[
m = \frac{h_2}{h_1} = \frac{-v}{u}
\]

where \(h_2\) → image height from principle axis.

\(h_1\) → Object height from principle axis.

If magnification \(m > 1\) ______ Image is magnified

\(m = 1\) ______ Image is of same size

\(m < 1\) ______ Image is diminished.

To Remember Sign Conventions for Spherical Mirror

(1) Object Distance \(u\) is Always Negative

(2) Image Distance \(v\) is REAL IMAGE – Negative VIRTUAL IMAGE – Positive

(3) Focal length and radius of Curvature \(F\) & \(R\) is CONCAVE MIRROR – Negative CONVEX MIRROR – Positive

(4) Height of the object \(h_1\) is Always Positive
(5) Height of the image \( h_2 \) is

FOR REAL IMAGE – Negative
FOR VIRTUAL IMAGE – Positive

(6) Magnification \( m = \frac{h_2}{h_1} \) is

FOR REAL IMAGE – Negative
FOR VIRTUAL IMAGE – Positive

**Refraction of Light**

**Refraction of Light** : Happens in *Transparent medium* when a light travels from one medium to another, refraction takes place.

A ray of light bends as it moves from one medium to another.

Refraction is due to change in the speed of light as it enters from one *transparent medium to another*.

*Speed of light decreases* as the beam of light travel from *rarer medium* to the *denser medium*.

![Diagram of refraction](image)

**SOME COMMONLY OBSERVED PHENOMENON DUE TO REFRACTION**

(1) The stone at the bottom of water tub appears to be raised.
(2) A fish kept in aquarium appears to be bigger than its actual size.

(3) A pencil partially immersed in water appears to be displaced at the interface of water and air.

REFRACTION THROUGH A RECTANGULAR GLASS SLAB

Here light ray changes its direction at $O$ and $O'$, the point at the interface of transparent medium.
Incident ray of light AO passes from rarer to denser medium (glass) at point O

At point O, on the interface AB it will bend towards normal (N) after refraction

Now reaches to point ‘O’, on the interface DC the light ray will move from denser to rarer medium (air), hence the ray will bend away from normal (N¹)

When the incident ray is extended to C i.e. AC, we will observe that emergent ray O’B is parallel to incident ray.

The ray will slightly displaced laterally after refraction.

Note: When a ray of light is incident normally to the interface of two media it will go straight, without any deviation.

**Laws of Refraction of Light**

1. The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.

2. The ratio of sine of angle of incidence to the sine of angle of refraction is a constant i.e.

\[
\frac{\sin i}{\sin r} = \text{constant (r)}
\]

for given colour and pair of media, this law is also known as Snell’s Law

**Constant \(n\)** is the refractive index for a given pair of medium. It is the refractive index of the second medium with respect to first medium.

\[
\frac{\sin i}{\sin r} = \frac{n_2}{n_1} = n_{r1}
\]

Where 2 is for second medium and 1 is for first medium

**REFRACTIVE INDEX** – Ratio of speed of light in the two media

It is denoted \([\text{n}]\)
The refractive index of medium 2 with respect to medium 1 is equal to the ratio of speed of light in medium 1 to the speed of light in medium 2.

\[ n_{21} = \frac{n_2}{n_1} = \frac{v_1}{v_2} = \frac{\text{Speed of light in medium 1}}{\text{Speed of light in medium 2}} \]

**ABSOLUTE REFRACTIVE INDEX**

The refractive index of a medium with respect air or vacuum is equal to ratio of speed of light in air or vacuum to the speed of light in medium.

\[ \text{Absolute Refractive index} = n_m = \frac{n_m}{n_{\text{air or vacuum}}} = \frac{\text{Speed of light in air or vacuum}}{\text{Speed of light in medium}} \]

\[ \therefore n_m = \frac{C}{V} = \frac{\text{Where } C = 3 \times 10^8 \text{ m/s}}{\text{C is constant}} \]

1. Refractive index of water = 1.33
2. Refractive index of glass = 1.52

**Spherical Lens**

A transparent material bound by two surfaces, of which one or both surfaces are spherical, forms a lens.

**Convex lens**

1. Bulging outwards
2. Converging lens.

**Concave lens**

1. Bulging inwards.
2. Diverging lens.

**Convex Lens**

A lens may have two spherical surfaces, bulging outwards, is called double convex lens (or simply convex lens).
It is also known as converging lens because it converges the light.

![Concave Lens](image)

**Concave Lens**

A lens bounded by two spherical surfaces, curved inwards is known as double concave lens (or simply concave lens).

It is also known as diverging lens because it diverges the light.

![Concave Lens](image)

**Few Basic terms related to Spherical Lens**

![Diagram of Spherical Lens](image)
1. **Centre of curvature**: A lens, either a convex lens or a concave lens is a combination of two spherical surfaces. Each of these surfaces form a part of sphere. The centre of these two spheres are called centre of curvature represented by C1 and C2.

2. **Principal axis**: Imaginary straight line passing through the two centres of curvature.

3. **Optical Centre**: The central point of lens is its optical centre (O). A ray of light, when passes through ‘O’ it remains undeviated i.e. it goes straight.

4. **Aperture**: The effective diameter of the circular outline of a spherical lens.

5. **Focus of lens**: Beam of light parallel to principal axis, after refraction from

1. **Convex lens**, converge to the point on principal axis, denoted by F, known as Principal focus

![Diagram 1](image1)

2. Concave lens, appear to diverge from a point on the principal axis known as principal focus.

![Diagram 2](image2)

The distance OF2 and OF1 is called as focal length

**Tips for Drawing Ray Diagram**

(a) After refraction, a ray parallel to principal axis will pass through F.

(b) A ray passes through F, after refraction will emerge parallel to principal axis.
(c) A ray passes through optical centre ‘O’, passes without any deviation.

**IMAGE FORMATION BY A CONVEX LENS**

1. **Position of Object** At infinity
   **Position of Image** At focus ‘F’
   **Size of Image** Highly diminished (Point Size)
   **Nature** Real & Inverted

2. **Object** Beyond ‘2F’
   **Image** Between F & 2F
   **Size of Image** Small
   **Nature** Real & Inverted

3. **Position of Object** At 2F
   **Position of Image** At 2F
   **Size of Image** Same Size of Object
   **Nature** Real & Inverted

4. **Position of Object** Between F and 2F
   **Position of Image** Beyond 2F
   **Size of Image** Enlarged
   **Nature** Real & Inverted
AFTER OBSERVING ABOVE FIVE DIAGRAM, WE CONCLUDE THAT

We have five position in common i.e. **At infinity, Beyond 2F, At 2F, Between F & 2F and at focus F** on either side of the lens.

When object is shifted towards focus $F_1$ (1) from infinity (5) the image formation will shifted towards infinity (e) from focus $F_2$ (a) on other side of lens (where screen is placed). and size of image increases gradually.

### 6. SPECIAL CASE

<table>
<thead>
<tr>
<th></th>
<th>Object Position</th>
<th>Image Position</th>
<th>Size of image</th>
<th>Nature</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Between $F_1$ &amp; O</td>
<td>On the same side of object</td>
<td>Enlarged</td>
<td>Virtual &amp; Erect.</td>
</tr>
</tbody>
</table>

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[Class X : Science]
Image Formation by Concave Lens

1. 
- **Object**: At infinity
- **Image**: At $F_1$
- **Size**: Very small
- **Nature**: Virtual & erect

2. 
- **Object**: Between infinity & O
- **Image**: Between $F_O$
- **Size**: Very small
- **Nature**: Virtual & erect

SIGN CONVENTION FOR REFRACTION BY SPHERICAL LEN

**INITIAL STEPS**
- Object should be always placed to the left side of lens
- All distances should be measured from ‘O’ optical centre
- According to graphical representation take optical centre as origin and than apply Cartesian system
FOR EXAMPLE

In this diagram

1. Object distance ‘u’ is Negative (-x-Axis)
2. Image distance ‘v’ is Positive (+x Axis)
3. Height of the Object ‘h₁’ is Positive (+y Axis)
4. Height of the image ‘h₂’ is Negative (-y Axis)
5. Focal length ‘F’ is Positive (+x Axis)
6. Radius of Curvature ‘R’ is Positive (+x Axis)

TIPS TO REMEMBER SIGN CONVENTIONS FOR SPHERICAL LENSES

1. Object Distance
   ‘u’ is Always Positive
   \[ \text{F & R} \]

2. Image Distance
   ‘v’ is Real - Positive
   Virtual - Negative

3. Focal length & Radius of Curvature
   \[ \text{F & R} \]
   Concave - Negative
   Convex - Positive
(4) Height of the object \( h_1 \) is Always Positive

(5) Height of the Image \( h_2 \) is Real - Negative
Virtual - Positive

**Lens Formula**

\[
\frac{1}{f} = \frac{1}{v} - \frac{1}{u}
\]

'O' → optical centre

\( f \) - distance between F and 'O'

\( u \) - distance of object from 'O'

\( v \) - distance of image from 'O'

\( R \) - distance between centre of curvature & 'O'

**Magnification**

It is defined as the ratio of the height of image to the height of object.

\[
m = \frac{\text{height of image}}{\text{height of object}} = \frac{h_2}{h_1} = \frac{v}{u}
\]

It is also related to ‘\( u \)’ & ‘\( v \)’

\[
m = \frac{v}{u}
\]

From equation h1

\[
m = \frac{h_2}{h_1} = \frac{v}{u}
\]

If magnification \( m > 1 \) → Image is magnified

\( m = 1 \) → Image is of same size

\( m < 1 \) → Image is diminished
Uses of Convex Lenses

(1) Used in spectacles to correct vision defect hypermetropia
(2) Used in microscope & Telescope
(3) Used as magnifying glass by watch maker
(4) Used in camera

Used of concave lens

(1) Used in spectacles to correct vision defect Myopia
(2) Used as spy hole in door

Power of Lens

The degree of convergence or divergence of light ray achieved by a lens is known as power of a lens.

Power

\[ P = \frac{1}{f} \]

It is defined as the reciprocal of its focal length Represented by \( P \).

Lens of short focal length has more power where as a lens of long focal length has less power.

If \( f \) is given in meter, then

\[ P = \frac{1}{f} \]

If \( f \) is given in cm, then

\[ P = \frac{100}{f} \]

SI unit of power of a lens is “dioptre” denoted by ‘D’
I dioptre or ID → It is the power of lens whose focal length is 1m

\[ ID = \frac{1}{1m} \quad \text{OR} \quad ID = 1m^{-1} \]

\[ \therefore f \text{ is } +ve \]

Power of concave lens or diverging lens is always negative

\[ \therefore f \text{ is } -ve \]

If any optical instrument has many lens, then net power will be

\[ P = P_1 + P_2 + P_3 \ldots \]

**QUESTION BANK**

**Very Short Answers Type Questions** (1 Mark)

1. If the angle of incidence is 0°, what is the angle of reflection?

2. What is the nature of image formed by concave mirror if the magnification produced by the mirror is +3?

3. Give two uses of concave mirror?

4. Find the focal length of a convex mirror, whose radius of curvature is 30 cm?

5. What do you understand by magnification of a spherical mirror?

6. An object is held at the principal focus of a concave lens of focal length f. Where the image will form?
7. Show the angle of incidence and angle of reflection.

![Angle of Incidence and Angle of Reflection](image)

8. Complete the ray diagram.

![Complete the Ray Diagram](image)

9. Define the SI unit of power of lens.

10. When light undergoes refraction at the surface of separation of two media, what happens to speed of light.

11. How can we find the focal length of a Convex lens quickly but approximately.

**Short Answer Type Questions**

1. What do you understand by refraction of light. Draw the labelled ray diagram, when ray of light passes through glass slab.

2. The refractive index of glass is 1.54 and the speed of light in air is $3 \times 10^8$ m/s. Calculate the speed of light in glass.

3. A convex mirror used in an automobile has a focal length of 6m. If vehicle behind is at a distance of 12m. Find the nature and location of image. (4m, virtual erect small)

4. A concave lens of focal length 15cm, forms an image 10 cm from the lens. How far is the object placed from the lens? Draw the ray diagram?

5. Two thin lens of power +3.5D and -2.5D are placed in contact. Find the power and focal length, if the lens are in combination.(p = +1D, f = 1m)

6. What are the laws of refraction. Define refractive index of a medium.

7. How we can differentiate between convex and concave lens without touching it.
8. The Power of a combination of two lens XY is 5D if the focal length of lens X is 15 cm. State the Nature & focal length of lens Y. (–60 cm. Concave lens.)

Very Long Answer Type Questions (5 Marks)

1. Draw the ray diagram, showing the image formed by concave mirror, when object is placed at
   (a) at infinity
   (b) between F and 2F
   (c) At 2F
   (d) At F
   (e) between F&P

2. Draw the ray diagram, showing the image formed by convex lens, when object is placed at
   (a) At infinity
   (b) between \(F_1\) and \(2F_1\)
   (c) At \(2F_1\)
   (d) At \(2F_1\)
   (e) between \(F_1\) & optical centre ‘O’
In this chapter we will study Human eye that uses the light and enable us to see the objects.

We will also use the idea of refraction of light in some optical phenomena in nature i.e. Rainbow formation, twinkling of star, blue and red colour of sky etc.

Human Eye : A Sensitive sense organ

It acts like a camera, enable us to capture the colourful picture of the surroundings.

It forms an inverted, real image on light sensitive surface Retina

HUMAN EYE
The Various Parts of Eye and their Functions

1. **Cornea**: It is a thin membrane through which light enters. It forms the transparent bulge on the front of eyeball. Most of the refraction occurs at the outer surface of the cornea.

2. **Eyeball**: it is approximately spherical in shape, with a diameter of about 2.3cm.

3. **Iris**: It is a dark muscular diaphragm that controls the size of pupil. It is behind the cornea.

4. **Pupil**: It regulates and control the amount of light entering the eye. It is the black opening between aqueous humour & lens.

5. **Crystalline eye lens**: Provides the focussed real & inverted image of the object on the retina. It is composed of a fibrous, jelly like material. This is convex lens that converges light at retina.

6. **Ciliary muscles**: It helps to change the curvature of eyellens and hence changes its focal length so that we can see the object clearly placed at different positions.

7. **Retina**: Thin membrane with large no. of light sensitive cells.

8. When image is formed at retina, light sensitive cells gets activated and generate electrical signal. These signals are sent to brain via optic nerve. Brain analyse these signals after which we perceive object as they are.

**How Pupil Works?**

**Example**: You would have observed that when you come out of the cinema hall after watching movie, in the bright sun light, your eyes get closed. And when you enter the hall from the bright light, you won’t be able to see but after some time you would be able to see.

Here the pupil of an eye provides a variable aperture, whose size is controlled by iris

(a) **When the light is bright**: Iris contracts the pupil, so that less light enters the eye.

(b) **When the light is dim**: Iris expand the pupil, so that more light enters the eye.

Pupil opens completely, when iris is relaxed.

**Persistence of Vision**: It is the time for which the sensation of an object continue in the eye. It is about 1/16th of a second.
Power of Accommodation

The *ability of eye lens to adjust its focal length with the help of ciliary muscles* is called accommodation.

<table>
<thead>
<tr>
<th>Ciliary Muscles</th>
<th>Relaxed</th>
<th>Contract</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Eye lens becomes thin</td>
<td>1. Eye lens becomes thick</td>
<td></td>
</tr>
<tr>
<td>2. Increases the focal length</td>
<td>2. Decreases the focal length</td>
<td></td>
</tr>
<tr>
<td>3. Enable us to see distant object clearly</td>
<td>3. Enable us to see nearby object clearly</td>
<td></td>
</tr>
</tbody>
</table>

**Near point of the Eye**

It is 25cm for normal eye. The minimum distance at which object can be seen most distinctly without strain.

**For point of the Eye**

It is infinity for normal eye. It is the farthest point upto which the eye can see objects clearly.

Rods & Cones

These are two kinds of light sensitive cells on the retina.

1. Rods → Rod Shape cell present in the retina of an eye which are sensitive to dim light - It do not provide the information about the colour of Object. ‘Owl’ have large rode cells in their retina.

2. Cones → Cone shape cell present in the retina of an eye which are sensitive to bright light (Or normal light). There cells respond to the colour.

Defects of Vision and their Correction

1. **Cataract** : The image can not be seen distinctly because eye lens become milky and cloudy. This condition is known as cataract, it can cause complete or partial loss of vision.

   This can be corrected by surgical removal of extra growth (cataract surgery).

2. **Myopia : (Near Sightedness)**

   A person can see nearby object clearly, but cannot see distant object distinctly.
The Reason of defect

1. Excessive curvature of eye lens means Eye lens becomes thick and its focal length decreases.

2. Elongation of the eye ball.

Correction

Corrected by using a Concave Lens of appropriate power.

3. **Hypermetropia (Far - Sightedness)**

A person cannot see nearby object clearly, but can see distant object distinctly.
The Reason of defect

1. Increase in focal length of the eye lens (Thin eye lens)
2. Eye ball has become too small.

Correction

Corrected by using a [CONVEX LENS] of appropriate power.

Correction of Hypermetropic eye

4. **Presbyopia**

As we become old, the power of accommodation of the eye usually decreases, the near point gradually recedes away. This defect is called Presbyopia, a special kind of Hypermetropia.
Person may suffer from both myopia and hypermetropia.

**Reason of defect**: Gradual weakening of ciliary muscles and decreasing the flexibility of the eye lens.

**Correction**: Using Bifocal lens with appropriate power.

Bifocal lens consist of both concave and convex lens, upper position consist of concave lens and lower portion consist of convex lens.

**Refraction of Light through a Prism**

**Prism**: It has two triangular bases and three rectangular lateral surfaces.

These surfaces are inclined to each other. The angle between its two lateral faces is called **Angle of Prism**.

![Diagram of Prism](image)

**Angle of Deviation (D)** → The angle between the incident ray and emergent ray.

Dispersion of white light by a Glass Prism

![Diagram of Dispersion](image)

\[ \angle D_{	ext{violet colour}} > \angle D_{	ext{red colour}} \]
Inclined refracting surfaces of glass prism show exciting phenomenon.

**Splitting of White Light into Band of Colours**

The band of the coloured components of light beam is called **Spectrum** *i.e.* VIBGYOR

The splitting of light into its component colours is called **Dispersion**.

The different component colour of light bends at different angle with respect to incident angle, the red light bends the least while the violet bends most.

**ISSAC NEWTON** → He was the first, who obtained spectrum of sunlight by using glass prism.

He tried to split the spectrum of white light more by using another similar prism, but he could not get any more colours.

He repeated the experiment using second prism in an inverted position with respect to the first prism.

Allowed all the colours of spectrum to pass through second prism. He found white light emerges on the other side of second prism.

He concluded that sun is made up of seven visible colour ‘VIBGYOR’

**RAINBOW** → It is the spectrum of sunlight in nature. It is formed due to the dispersion of sunlight by the tiny water droplet, present in atmosphere.

**Water Droplet Act like Prism**

It refracts and disperses the incident sunlight, then reflects it internally (internal reflection) and finally refracts it again, when it emerges out of the water droplet.

A rainbow is always formed in a direction opposite to that of sun.

Due to dispersion and internal reflection of light, different colours reach the observer’s eye.
Red colour appears on top & violet at the bottom of rainbow

At ‘A’ → Refraction & dispersion takes place
At ‘B’ → Internal refraction takes place
At ‘C’ → Refraction & dispersion takes place

Atmospheric Refraction

1. **Apparent Star Position**: It is due to atmospheric refraction of starlight.

   The temperature and density of different layers of atmosphere keeps varying. Hence we have different medium.

   Distant star act as point source of light. When the starlight enter the earth’s atmosphere it undergoes refraction continuously, due to changing refractive index *i.e.* from Rarer to denser, it bends towards the normal.

   Due to this the apparent position of the star is different from actual position.

   The star appears higher than its actual position.

2. **Twinkling of Star**: It is also due to atmospheric refraction.

   Distant star act like a point source of light. As the beam of starlight keeps deviating from its path, the apparent position of star keeps on changing because physical condition of earth’s atmosphere is not stationary.

   Hence the amount of light enters our eyes fluctuate some time bright and some time faint.
This is the “Twinkling effect of star”.

Q. Why Planets do not twinkle?

Ans. Planets are closer to earth and are seen as extended source of light i.e. the collection of large no. of point sized sources of light. Therefore, the total amount of light entering our eyes from all individual point source will nullify the twinkling effect.

3. Advance Sunrise and delayed sunset: This is also due to atmospheric refraction.

Because of this sun is visible about 2 minutes earlier than actual sunrise and about 2 minutes after the actual sun set.

Apparent flattering of the sun’s disc at sun set and sun rise is due to atmospheric refraction.

Scattering of Light

Scattering of Light It means throwing of light in various random direction.

Tyndall Effect: When a beam of light strikes the minute particle of earth’s atmosphere, i.e., suspended particles of dust and molecule of air, the path of beam becomes visible. The phenomenon of scattering of light by the colloidal particle gives rise to Tyndall Effect.

Tyndall Effect

The scattering of light by particle in its path is called Tyndall effect.

It can be observed when sunlight passes through a canopy of a dense forest.

The colour of the scattered light depends on the size of the scattering particles.

The colour of the scattered light depends on size of particles
Very Fine Particles

Nitrogen and Oxygen gas molecules in an area smaller in size than the wavelength range of visible light i.e.

\[ 4 \times 10^{-7} \text{M (VIOLET)} \text{ to } 8 \times 10^{-7} \text{M (RED)} \]

So, when sunlight falls on these small particles, it is not scattered as white light.

The air molecule will scatter the lower wavelength [length of the wave denoted by \( \lambda \) (lambda)] of light which is blue in colour.

This is why Sky is blue in colour.

Large Size Particles

Dust particles and water droplets suspended in the atmosphere are larger than the range of visible light.

When white light hits these large particles, it gets reflected or scattered in different directions.

The colour of white light is also reflected or scattered in the same way. Hence it appears white because all colours are scattered almost equally.

This is why cloud appears white in colour.

According to Rayleigh scattering,

\[
\text{Scattering of light } \propto \frac{1}{\lambda^4} (\lambda - \text{Wavelength})
\]

Scattering of light decreases with increase in wavelength.

Q. If there is no earth’s atmosphere? What will happen to scattering phenomenon?

Ans. There will be no scattering and sky will appear dark.

3. Colour of the Sun at Sunrise and Sunset.

While sunset and sunrise, the colour of the sun and its surrounding appears red.

During sunset and sunrise, the sun is near the horizon, and therefore the sunlight has to travel a larger distance in the atmosphere. Due to this, most of the blue light (shorter wavelength) are scattered away by the particles. The light of longer wavelength (red colour) will reach our eye. This is why the sun appears red in colour.

4. Why the danger signal or sign are made of red colour.

Red colour scattered the least when strikes the small particle of fog and smoke because it has the maximum wavelength (visible spectrum). Hence at large distances also, we can see the red colour clearly.

5. At noon sun appear white:

At noon, the sun is overhead and sunlight would travel a shorter distance relatively through the atmosphere. Hence, at noon, the Sun appear white as only little of the
blue and violet colours are scattered.

(In the early morning or evening)

(Blue scattered away sun appear reddish)

Light Travel large distance in atmosphere.

Sun near horizon

Earth

Atmosphere

(In the afternoon)

Light travel less distance in atmosphere.

(Less blue scattered)

**QUESTION BANK**

**VERY SHORT ANSWERS (1 MARK)**

1. What is the phenomenon responsible for the blue colour of sky?
2. What is the near and far point of a normal eye?
3. Name the component of eye that is responsible for the adjustment of eyeflens?
4. To an astronaut why does the sky appear dark instead of blue?
5. How can you remove the defect of vision ‘Presbyopia’.
6. Name three primary colour? (Ans. RED, BLUE, GREEN)
7. Write the nature of image formed by our eye?
8. What do you understand by Dispersion of light?
9. What is Tyndall Effect?
10. A student has difficulty in reading the blackboard while sitting in the last row. What is the defect of vision and how it can be corrected?
11. What is the value of Power of Accommodation of Person having normal eyesight?
12. Name the Part of the retina which is sensitive of light?
**SHORT ANSWERS (2 MARKS)**

1. Name the phenomenon responsible for formation of rainbow? Explain it with the help of diagram?

2. What is power of accommodation. How ciliary muscles helps in accommodation?

3. Why the sun appear red while sunset and sunrise. Explain?

4. Why the star twinkle but not earth planets?

5. Explain the function of
   (i) Iris (ii) Pupil (iii) Retina

6. Explain the refraction of light through glass prism with the help of diagram. Show angle of emergence and angle of deviation?

7. Name
   (a) the Eye defect which can’t be corrected by any type of lens.
   (b) the Old Age hypermetropia.

**LONG ANSWER TYPE QUESTIONS (5 MARKS)**

1. What is myopia. State the two causes of myopia? With the help of labelled ray diagram show
   (a) Eye defect
   (b) Correction of myopia

2. What is hypermetropia. State the two causes? With the help of labelled ray diagram show
   (a) Eye defect
   (b) Correction of hypermetropia.

3. Draw the labelled diagram of human eye and explain the image formation?
CHAPTER - 15

OUR ENVIRONMENT

- Environment means everything which surrounds us. It may include living (biotic) and non-living (abiotic) components.

- Biotic : Plants and animals. Abiotic : Air, water etc.

- Environment affect the life and development of an organism in its natural habitat & vice a versa.

- Substances that can be decomposed by the action of micro-organism like bacteria are called bio-degradable. E.g. organic wastes.

- Substances which cannot be decomposed by the action of microorganisms are called non-biodegradable.

- Example of biodegradable wastes : cattle dung, cotton, jute, paper, fruit and vegetable peels, leaves etc.

- Examples of non-biodegradable wastes : plastics, polythene bags, synthetic fibres, metals, radioactive wastes.

ECO SYSTEM & ITS COMPONENT

- All the interacting living organisms in an area together with non living components form an ecosystem. So an ecosystem consists of both biotic (living creatures) and abiotic components like temperature, rainfall, wind, soil etc.
All living organisms are classified on the basis of nutrition.

I. **Producers** : All green plants, blue green algae can produce their food (Sugar & starch) from inorganic substance using light energy (Photosynthesis).

II. **Consumers** : Include organisms which depend on the producers either directly or indirectly for their sustenance. Consumers depend on others for food.

   - **Herbivores** – Grass eaters
     - *E.g.* Cow, dear
   - **Carnivores** – Flesh Eaters
     - *E.g.* Lion, Tiger
   - **Parasite** – Live & feed on the host body
     - *E.g.* Plasmodium
   - **Omnivores** – Feed on both plant and flesh.
     - *E.g.* Crow

III. **Decomposers** : Fungi & Bacterias which break down (decompose) the dead plant, animals complex compounds into the simpler one. Thus decomposers help in the replenishment of the natural resources.

- **Food Chain** : It is the sequence of living organisms in which one organism consumes another organism for energy. It is unidirectional (single directional).

  For Eg. \[ \text{Grass} \rightarrow \text{Dear} \rightarrow \text{Lion} \]

  A 3-step Food chain
- **Food Web**: It is a network of a large no. of food chains which are interconnected.

- In a food chain, various steps where transfer of energy takes place is called a trophic level.

- The green plants capture 1% of sun’s energy.

- The flow of energy is unidirectional in a food chain.

- There is gradual decrease in the amount of energy from one trophic level to next trophic level in a food chain.

- **10 Percent Law**: The energy available at each successive trophic level is 10% of the previous level.

  So only 10% of Energy is transferred to next trophic level while 90% of energy is used by present trophic level in its life processes.

- The conc. of harmful chemical increases with every next trophic level in a food chain. It is called Bio-magnification For *e.g.*

<table>
<thead>
<tr>
<th>Mammal</th>
<th>DDT</th>
<th>Plant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass</td>
<td>(10 ppm)</td>
<td>(10 ppm)</td>
</tr>
<tr>
<td>Deer</td>
<td>(200 ppm)</td>
<td>(200 ppm)</td>
</tr>
<tr>
<td>Lion</td>
<td>(5000 ppm)</td>
<td>(5000 ppm)</td>
</tr>
</tbody>
</table>

- **Eagle**
- **Frog**
- **Insect**
- **Plant**
- **Mouse**
- **Sparrow**
- **Snake**
Maximum concentration of such chemicals get accumulated in human bodies. Since humans occupy the top level in any food chain.

ENVIRONMENTAL PROBLEMS

Changes in environment affect us and our activities change the environment around us. Environmental problems caused by humans: (a) depletion of the Ozone Layer and waste disposal. (b) pollution due to mismanagement of waste disposal.

I. Depletion of Ozone Layer

- Ozone (O3) layer is largely found in the stratosphere which is a part of our atmosphere from 12 km – 50km above sea level.
- Ozone is a deadly poison at the ground level.
- Ozone is formed as a result of a following photochemical reaction.

\[
\begin{align*}
O_2 & \xrightarrow[\text{UV}}\text{(1800°A to 2000°A)}]{} O + O \quad \text{(Splitting of molecular oxygen)} \\
O_2 + O & \rightarrow O_3 \quad \text{(Ozone)}
\end{align*}
\]

- Ozone layer is a protective blanket around earth which absorbs most of the harmful U.V. (Ultraviolet) radiation of the Sun, thus protecting the living beings of the earth from health hazards like skin cancer, cataract in eyes, weaken immune system, destruction of plants etc.
- The decline of Ozone layer thickness in Antartica was first observed in 1985 and was termed as OZONE HOLE.

Reason of Ozone Depletion

Excessive use of CFCs (Chloro Flouro Carbon) a synthetic, inert chemical. E.g. Freon which are used as refrigerants and in fire extinguishers, caused Ozone depletion in the upper atmosphere. A single chlorine atom can destroys 1,00,000 Ozone molecules. U.N.E.P. (United Nation Environment Programme) did an excellent job in forging an agreement to freeze CFC production at 1986 levels (KYOTO Protocol) by all countries.
Garbage Disposal

Industrialization and rise in demand of consumer goods have created a major problem in the form of wastes/garbage accumulation and its disposal especially in urban area.

The different methods of solid wastes disposal commonly used around the world are.

1. **Open dumping**: A conventional method in which solid wastes dumped in selected areas of a town. It actually cause pollution

2. **Land fillings**: Wastes are dumped in low living area and are compacted by rolling with bulldozers

3. **Composting**: Organic wastes are filled into a compost pit (2m × 1m × 1m). It is then covered with a thin layer of soil. After about three months the same garbage filled inside the pit changes into organic manure.

4. **Recycling**: The solid wastes is broken down into its constituent simpler materials. These materials are then used to make new items. Even non-bio degradable solid wastes like plastic, metal can be recycled.

5. **Reuse**: A very simple conventional technique of using an item again & again. For e.g. paper can be reused for making envelops etc.

---

**QUESTION BANK**

**Very Short Answers** (1 Mark)

1. Define Biomagnification

2. Expand the term CFC & U.N.E.P.

3. Define Ozone hole

4. Which of the following is/are Biodegradable: plastic cups, cowdung, aluminium foil, cotton.

5. Define food web.

6. Define Ecosystem
7. Which bag would you prefer for shopping and why?
   (i) Jute bag
   (ii) Polythene bag

8. Why is ozone layer important for the existence of life on earth?

Short Answer (2 Marks)
1. Differentiate between Biodegradable and non biodegradable wastes. Give two examples.
2. Use of Kulhads was not environment friendly idea. Why?
3. Draw an Energy Pyramid showing different trophic level.
4. What is the advantage of disposable paper cup use over plastic cups?
5. How can we help in reducing the problem of waste disposal? Give any two methods.
6. What is role of decomposer in Ecosystem.
7. Give any two ways in which non biodegradable substance would affect the environment.
8. What are trophic levels? Give an example of a food chain and state the different trophic levels in it.
9. What will happen if we kill all the organisms of one trophic level?
10. Study the food chain given below:
    (i) Grass → Grasshopper → Frog
    (ii) Wheat → Rat → Snake → Hawk

Which of the two consumers frog/hawk will get more available energy and why?

Short Answer (3 Marks)
1. State various modes of waste disposal.
2. Explain how harmful chemicals enter our body.

3. Why does concentration of harmful chemicals increase whereas energy level decrease, from lower to higher trophic level in a food chain?

**Long Answer** (5 Marks)

1. (i) What is ozone? How is it formed.
   
   (ii) State the significance of ozone layer.
   
   (iii) Give reason for depletion of ozone layer.
CHAPTER - 16

MANAGEMENT OF NATURAL RESOURCES

- **Natural Resources**<br>Resources provided to us by nature<br>Soil, air, water, forests<br>wildlife, coal and petroleum are used by man for his survival.

- **Types of Resources**<br>(a) *Exhaustible* : present in limited quantity e.g. coal, petroleum.<br>(b) *Inexhaustible* : present in unlimited quantity e.g. air, water.

- Management of natural resources is needed for conservation of natural resources.

- There are National and International Laws and Acts to protect the environment.


- Contamination of river water is indicated by the presence of coliform (a group of bacteria found in human intestine) and acidic water (can be tested by the ph paper).

<table>
<thead>
<tr>
<th>1993-94 Total Coliform (MPN/100ml)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum found in Rishikesh 600-650MPN/100ml</td>
</tr>
<tr>
<td>Minimum desired level 450MPN/100ml</td>
</tr>
<tr>
<td>Maximum found in Kannauj 1400MPN/100ml</td>
</tr>
</tbody>
</table>

- MPN → Most probable number.

- National Award for wildlife conservation – in the memory of Amrita Devi Bishnoi who lost her life in the protection of Khejri trees in Rajasthan along with 363 other people.
- **Chipko Andolan**: Movement originated in Garhwal in early 1970s that was the result of a grassroot level effort to end the alienation of people from their forest.

- Protection of Sal forest in West Bengal in 1972.

- Three R’s to save the environment.
  
<table>
<thead>
<tr>
<th>Reduce</th>
<th>Recycle</th>
<th>Reuse</th>
</tr>
</thead>
<tbody>
<tr>
<td>means use less</td>
<td>Segregate the waste that can be recycled and use to make required things.</td>
<td>use the things again and gain.</td>
</tr>
<tr>
<td>Save the resource by not wasting them</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

  - Reuse is better than recycling as it saves energy.

  - Management of Natural Resources is necessary so that these may last for the generations to come and are not exploited for short term gains.

- **Forest and wild life conservation** – Forests are biodiversity hot spots. **Biodiversity** of an area is the number of species of different life forms like bacteria, fungi, flowering plants, insects, birds etc.

  - **Hotspot** means an area full of biological diversity.

  - loss of diversity may lead to a loss of ecological stability/ ecological imbalance.

**STAKE HOLDERS**

A person having interest or concern for some thing is called as stake holder.

**Stakeholders of forests : (their dependence on forests)**

- **Local People** (dependent on forests for their survival)
- **Forest Department** (Govt. who owns the land and controls resources)
- **Industrialists** (Who use various forest products)
- **Wild life enthusiasts** (who want to conserve nature)

**Sustainable Management**

Management of resources wisely to make them available for future generations.
Water

- Water is a basic necessity for all terrestrial forms of life.
- Irrigation methods like dams, tanks and canals have been used in various part of India.

Dams

- **Advantages of Dams** – Ensures adequate water for irrigation (sufficient to satisfy need).
- Generate electricity.
- Continuous supply of water in regions.

Disadvantages

- No equitable distribution of water.
- Large no. of people displaced without compensation.
- Involves huge amount of Public money without giving proper benefits.
- Causes deforestation and loss of biological diversity.

- **Water Harvesting** : Collection of rain water and its utilisation for various purposes.

- **Advantages of storing water in the ground** :
  
  (a) It does not evaporate.
  
  (b) It spreads out to recharge wells.
  
  (c) It provides moisture for vegetation over a wide area
  
  (d) It does not provide breeding grounds for mosquitoes.
  
  (e) It is protected from contamination by human and animal waste.
Various ancient methods of water harvesting

<table>
<thead>
<tr>
<th>Method</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khadin, tanks, nadis</td>
<td>Rajasthan</td>
</tr>
<tr>
<td>Bandharas, tals</td>
<td>Maharashtra</td>
</tr>
<tr>
<td>Bundhis</td>
<td>Madhya Pradesh and U.P.</td>
</tr>
<tr>
<td>Pynes, ahars</td>
<td>Bihar</td>
</tr>
<tr>
<td>Kulhs</td>
<td>Himachal Pradesh</td>
</tr>
<tr>
<td>Ponds</td>
<td>Jammu Region</td>
</tr>
<tr>
<td>Eris (tanks)</td>
<td>Tamilnadu</td>
</tr>
</tbody>
</table>

Bawlis – Old method of water harvesting in Delhi and near by region.

**COAL AND PETROLEUM**

- Coal and petroleum are non-renewable natural resources.
- Coal was formed from the remains of trees buried deep inside the earth some 500 million years ago.
- Petroleum is formed by the bacterial decomposition of dead marine plants and animals (burried at the bottom of the seas. This decomposition takes place under high pressure and temperature and formation of petroleum take millions of years of time.
- Coal and petroleum are called fossil fuels.
- Very soon coal and petroleum will be exhausted.
- At present rate of usage, petroleum will last us for about 40 years and the coal resources will last for another 200 years.
- Harmful effects of using fossil fuels:
  * Combustion of coal and hydrocarbons release a large amount of carbon monoxide, carbon dioxide, sulphur dioxide, oxides of nitrogen, etc. These cause air pollution and cause various diseases like respiratory and throat problems congestion etc.
* Excessive emission of green house gases like carbon dioxide cause a rise in atmospheric temperature (Global Warming).

Q.1 Why should we use fossil fuels judiciously?

Ans. Fossil fuels are limited and exhaustible. Once exhausted, coal and petroleum will not be available to us in near future because they are formed extremely slowly over a very long time.

Q.2 Write the steps you can take to reduce the consumption of coal and petroleum.

Ans. * Switch off electricity appliance when not needed.

* Use public transport instead of private one.

* Whenever possible, use solar cooker.

* Use stairs to climb instead of lift.

**QUESTION BANK**

Very Short Answers (1 Mark)

1. Why is it necessary to conserve our environment?

2. Define sustainable development

3. Name any two exhaustible resources

4. What is the most conductive PH range for the life of fresh water plants?

5. List two advantages of water harvesting.

6. Why is reuse better than recycle?

7. Define biodiversity.

8. List two steps you would take to conserve electricity in your house.

9. Who are called stake holders?
10. Name some traditional water harvesting systems in India.

**Short Answers** (2 Marks)

1. How is mining a cause of pollution?
2. Make a list of four forest products that we use.
3. How is burning of fossil fuels affecting our environment?
4. Suggest two measures for controlling CO₂ levels in atmosphere.
5. Why should we conserve forest and wildlife?

**Short Answers** (3 Marks)

1. What are the three main problems from dams?
2. How can you reduce energy consumption at your level. Suggest at least three points.
3. Explain ‘Reduce’, ‘Recycle’ and ‘Reuse’.

**Long Answers** (5 Marks)

1. What is the main objective of water harvesting techniques? Name an ancient water harvesting structure used in India. Mention 3 causes for failure to sustain water availability under ground?

2. Discuss the damage caused to forest by the following activities:
   
   (a) Building rest houses for 10% tourists in national parks.

   (b) Grazing domestic animals on National Parks.

   (c) Tourists throwing plastic bottles, covers and other things in National Parks.
**SOLUTIONS**

**CHAPTER 4**

A  1. Hint : Sharing of valence electrons. (इलेक्ट्रॉन की साझेदारी)

   2. **Hint** : Sharing of electrons between H and O

   ![Diagram of H and O sharing electrons]

8. Propanone $\text{CH}_3\text{COCH}_3$

10. $\text{C}_6\text{H}_{10}$

B  7. Pentanal

![Structure of Pentanal]

Methanoic Acid

![Structure of Methanoic Acid]

D2(i) A is $\text{CH}_3\text{COOH}$ - Acetic Acid

(ii) B - is Ester $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$

(iii) Used in perfumes, cakes etc.

(iv) $2\text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \rightarrow 2\text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$

   (Gas is $\text{CO}_2$)

(v) **Hint** : Dilution.
A (i) Ca, Sr, Ba

4. **Hint**: third period indicates M shell with max. capacity of $2n^2$ i.e. 8 electrons.

5. Na, K.

9. 18 vertical columns (groups), 7 horizontal rows (periods)

B 2. **Hint**: (Atomic size increases as we more down a group)

D 3. a. A, B and C, D

   b. A and C, B and D

   c. C - more reactive.
V.S.A.

1. 0°

2. Virtual, erect and magnified. (आभासी, सीधा तथा आवृत्ति)

3. Shaving, by dentists. (शोविंग, दंत विशेषता)

4. \( f = +15 \text{ cm.} \)

5. \( m = \frac{h_i}{h_o} = \frac{-v}{u} \)

6. Between O and F. (O तथा F के बीच)

7. \( \angle ABC = \angle i \)

8. \( \angle CBF = \angle r \)
9. \[ 1 \text{ Dioptre} = \frac{1}{\text{focal length (1m)}} \quad \left( 1 \text{ डियोप्टर} = \frac{1}{	ext{फोक्स दूरी (1m)}} \right) \]

10. Speed of Light changes (प्रकाश की गति बदल जाती है)

11. Take an object at infinity, after refraction, where the image is formed, is focus of convex lens. (अनंत पर रखी वस्तु का प्रतिबिंब अपवर्तन के बाद, फोक्स पर बनेगा)

S.A.

1. \[ n = \frac{c}{v} \]

2. \[ n = \frac{c}{v} \]

\[ 1.54 = \frac{3 \times 10^8}{v} \]

\[ v = \frac{3 \times 10^8}{1.54} \]

\[ = 2 \times 10^8 \text{ m/s} \]

3. \[ \frac{1}{f} = \frac{1}{v} + \frac{1}{u} \]

\[ \frac{1}{-6} = \frac{1}{v} + \frac{1}{-12} \]
on solving

\[ v = +4 \text{ m.} \]

\[ m = \frac{-v}{u} \]

\[ = \frac{-4}{-12} = \frac{1}{3} \]

Virtual, erect and small

4. \[ \frac{1}{f} = \frac{1}{u} - \frac{1}{v} \]

\[ \frac{1}{-15} = \frac{1}{-10} - \frac{1}{u} \]

\[ \frac{1}{u} = \frac{-1}{30} \]

\[ u = -30 \text{ cm.} \]

5. \[ P = P_1 + P_2 \]

\[ = 3.5 - 2.5 = 1 \text{ D.} \]

\[ f = \frac{1}{P} = \frac{1}{1} = 1 \text{ m.} \]

8. \[ P = P_x + P_y \]

\[ 5 = \frac{100}{13} + \frac{1}{f_y} \]

\[ f_y = \frac{-3}{8} \times \frac{20}{9} \]
$f_y = -60 \text{ cm.}$

Concave lens

**CHAPTER 11**

**V.S.A.**

1. Scattering of light (प्रकाश का प्रकृतिकरण)

2. Near point –25 cm. (निकट बिंदु – २५ सेमी)
   
   Far point - Infinity (दूर बिंदु – अनंत)

3. Ciliary muscles. (पश्चाधी शक्तियाँ)

4. Because there is no atmosphere. (बाह्य वातावरण के अभाव में)

5. Bifocal lens. (बिफोकल लेंस)

6. Red, Blue, Green. (लाल, नीला, हरा)

7. Real and inverted. (वास्तविक तथा उल्टा)

8. Splitting of light into its component colours. (प्रकाश का अपने घटक रंगों में विभाजन)

10. Myopia, can be corrected by concave lens. (मायोपिया, अवज्ञ की लेंस)

12. Retina (रेटिना)
SECTION-A

1. List two characteristics of covalent compounds.
2. List two factors that lead to the rise of new species.
3. Write the full form of CFC.
4. What is significance of sustainable development?
5. Consider the following food chain
   Grass → Goat → Tiger
   If tiger has 40 J of energy available in this food chain. How much energy was available in grass?
6. Mention one similarity and one difference between the image formed by a plane mirror and convex mirror.
7. Out of the following identify the homologous organs giving reason for your choice-
   wings of a bird, wings of a butterfly, forearms of a lizard, hands of man.
8. A metal M (2, 8, 3) combines separately with oxygen, chlorine and nitrogen.
   (1) Write the formulae of the three compounds formed.
   (2) Identify the group and period of the periodic table to which this metal belongs.
   (3) Will the compounds formed be ionic or covalent?
9. Write the equation for reaction when acetic acid and ethyl alcohol are warmed together in the presence of Cone. H₂SO₄. Name the reaction. Also write the reaction by which acetic acid and ethyl alcohol can be obtained back from the product formed. Name this reaction also.

10. What are oxidising agents? Give two examples. Giving chemical equation of the reaction explain how are they used in the preparation of organic acids from alcohol.

11. Write any three differences between soaps and detergents.

12. Harsh was in a habit of crushing flowers for playing with their yellow powder. His friend Nikunj told him that each pail of a flower is important and we should admire their beauty and should try to protect them.

(a) What does the yellow powder of flower contain?
(b) State the kind of reproduction carried out by these flowers containing this kind of yellow powder.
(c) What value do you learn from Nikunj?

13. Mention any three advantages of variation in individuals?

14. Explain the need for uterine wall becoming thick and spongy at the time of ovulation.

15. How green beetles had colour advantage over red beetles? Explain.

16. An object 50 cm tall is placed on the principal axis of a convex lens. Its 20 cm tall image is formed on the screen placed at a distance of 10 cm from the lens. Calculate the focal length of the lens.

17. Find the position, nature and size of the image formed by a convex lens of focal length 20 cm of an object 4 cm high placed at a distance of 30 cm from it.

18. A convex mirror used for rear-view of an automobile has a radius of curvature 3.0 m. If a bus is located at 5.0 m from this mirror find the position, nature and relative size of the image.

19. List three problems addressed due to construction of large dams such as Tehri Dam on River Ganga.
20. (i) Write the names if the functional group present in

(a) \( R'\quad C=O \quad R \)
(b) \( R'\quad C=O \quad H \)

(ii) Describe a chemical test to distinguish between ethanol and ethanoic acid.

(iii) Write a chemical equation to represent what happens when Hydrogen gas is passed through an unsaturated Hydrocarbon in the presence of Nickel as a catalyst. Name the type of reaction that take place.

21. (a) What is meant by the term evolution? Define homologous and analogous organs.

(b) Mention the result of Mendel, when he reproduced the plants obtained in F1 progeny by self pollination?

22. How do the following organisms reproduce? Explain with the help of diagram.

(a) Plasmodium  
(b) Rhizopus
(c) Hydra  
(d) Bryophyllum

Write one common feature of this reproduction.

23. State the 's law of refraction and express it mathematically. Using lens formula, find the position of image, its nature, and magnification formed by a convex lens of focal length 20cm, when object is at 18 cm from it Also draw the ray diagram to show image formation (not to scale)

24. Draw the ray diagram in each case to show the position, nature of image formed when the object is placed -

(a) at the centre of curvature of concave mirror.
(b) Within focal length of a convex lens
(c) Between Pole and Focus of concave mirror
(d) In front of a convex mirror
(e) In front of a concave lens
SECTION - B

25. A student wants to trace the path of a ray of light through a glass slab. Which of the following will not be required for the purpose:
   (a) glass slab, alpines
   (b) drawing board, drawing board pins
   (c) plane paper, pencil, scale
   (d) white screen, stand to fix the screen

26. Identify homologous organs from the following:
   (a) Tails of bird, monkey and scorpion
   (b) Stings of honey bee, scorpion and fans of snake
   (c) Wings of butterfly, flying fish arid bird
   (d) Paddle of whale, front legs of horse and arms of human

27. The following figure show different stages of binary fission in Amoeba.

![Image of binary fission stages](image)

The correct sequence is:
   (a) A, B, C, D
   (b) D, B, C, A
   (c) B, C, A, D
   (d) B, C, D, A

28. The foam produced by soap in soft water is called
   (a) scam
   (b) fluff
   (c) lather
   (d) floes

29. When a ray of light is incident on the surface of prism -
   (a) it bends away from the normal
   (b) it bends towards the normal
(c) it goes parallel to the normal
(d) it goes along the normal

30. Study the given diagram in which a convex lens forms a virtual image of an object placed at a distance of 10 cm from it. The focal length of the lens must be:

(a) equal to 10 cm
(b) greater than 10 cm
(c) less than 10 cm
(d) less than 5 cm

31. Four students P, Q, R and S differently reported the following set of organs to be analogous:

P. Forelimb of a frog and forelimb of a lizard
Q. Forelimb of a bird and forelimb of a human
R. Wings of a parrot and wings of a butterfly
S. Wings of a bird and wings of a bat

The two students who have reported correctly are:

(A) P and Q
(B) Q and R
(C) R and S
(D) P and S

32. You are asked by your teacher to study the different parts of an embryo of a gram seed. Given below are the steps to be followed for the experiment:

I. Soak the gram seeds in plain water and keep them overnight.
II. Cut open the soaked seed and observe its different parts.
III. Take some dry gram seeds in a petri dish.
IV. Drain the excess water.
V. Cover the soaked seeds with a wet cotton cloth and leave them for a day.

The correct sequence of these steps is:

(A) III, I, V, IV, II
(B) III, I, II, IV, V
(C) III, IV, V, I, II
(D) III, I, IV, V, II

33. The path of a ray of light passing through a glass prism is shown below:

In this diagram the angle of prism, angle of incidence, angle of emergence and angle of deviation respectively have been represented by:

(A) O, Y, Z and N,
(B) P, Y, M and Z,
(C) O, X, M and Z,
(D) P, X, Z and N

34. When acetic acid added to sodium hydrogen carbonate solution in a test tube a brisk effervescence observed immediately and a transparent solution remain in the test tube. Which gas was liberated and write the chemical composition of the transparent solution.

35. Draw the labelled diagram for budding in yeast.

36. A student perform an experiment with convex lens and found the virtual image of an object. Find

(a) Position of the object
(b) Draw ray diagram for the above situation.
SECTION-A

1. State the reason why covalent compounds are generally poor conductor of electricity. 1

2. State the function of placenta. 1

3. Give two uses of Bamboo for local people. 1

4. The sky appears red at the time of sunrise and sunset, explain why? 2

5. There is a need to dispose waste in proper manner. Justify this statement giving reasons. 2

6. Construct a food chain in grassland comprising of five trophic levels. 2

7. Inert gases are placed in a separate group in the Modern Periodic Table.
   (a) State the group number
   (b) How many valence electrons do most of these gases have?
   (c) Why are they unreactive?
   (d) Name any two inert gases.

8. (a). Write the name of any three elements present in third period. 3
   (b) What will be the total number of shells in each and name the valence shell of each. Write configuration of all of these.

9. C_3H_6, C_4H_8 and C_5H_10 belong to the same homologous series. 3
   (i) Define homologous series.
(ii) Why the melting and boiling points of \( \text{C}_5\text{H}_{10} \) are higher than \( \text{C}_4\text{H}_8 \)?

(iii) Arrange these hydrocarbons in order of increasing boiling points.

10. Explain how the tendency to form electropositive ions changes on moving down a group.  

11. Classification of species is a reflection of evolutionary relationship. Explain with the help of an example.  

12. Identify whether

(a) -Budding as seen in *Hydra* is a type of sexual or asexual reproduction. Give reason for your answer.

(b) How is this process different from fission?  

13. Explain with the help of a figure that father is responsible for the sex of a child.  

14. (a) How would you relate the following methods to asexual reproduction?  

(i) Binary fission  

(ii) Spore formation  

(b) State any one advantage of sexual reproduction over asexual reproduction.  

15. It was observed that due to poor nourishment the average weight of beetles reduced. If this continues in a number of generations, will this feature direct evolution. Explain.  

16. (a) The refractive index of Ruby is 1.71. What is meant by this statement?  

(b) The refractive indices of some mediums are given below.

<table>
<thead>
<tr>
<th>Medium</th>
<th>Refractive Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crown glass</td>
<td>1.52</td>
</tr>
<tr>
<td>Water</td>
<td>1.33</td>
</tr>
<tr>
<td>Sapphire</td>
<td>1.77</td>
</tr>
</tbody>
</table>

In which of the following mediums is the speed of light:

(i) maximum  

(ii) minimum  

(c) Calculate the speed of light in sapphire.  

17. (i) Calculate maximum power of accommodation of a person having normal vision.  


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(ii) A person needs to use glasses for reading newspaper. Identify the defect in his vision and the type of lens he would need to correct it.

(iii) Sometimes when we enter into a dark room from bright sunlight we are unable to see objects clearly. Why?

18. A family is wasting lots of resources by running water taps, keeping their AC, TV Laptop etc on, throughout the day. You are upset on seeing all this and want to do something about it.

(a) How will you convince the family about not to waste resources? Give three arguments that you will use.

(b) State any three values that are inculcated in the members of the family with such . . . approach?

19. An organic compound ‘A’ of molecular formula $C_2H_4O_2$ is widely used as preservative in pickles. This compound reacts with ethanol to form a sweet smelling compound ‘B’.

(i) Identify the compound A.

(ii) Write the chemical equation for the reaction involved.

(iii) Name the reaction.

(iv) Name the gas produced when compound ‘A’ reacts with washing soda. Write chemical equation for the reaction.

Write the recessive trait in case of the following dominant traits.

20. Dominant  |  Recessive

(a) Flower position  |  axial

(b) Inflated pod shape
(c) Tall plant

(d) Write the dominant trait in case of the following recessive trait.

<table>
<thead>
<tr>
<th>Recessive</th>
<th>Dominant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow pod colour</td>
<td>——</td>
</tr>
<tr>
<td>Green seed colour</td>
<td>——</td>
</tr>
</tbody>
</table>

21. Explain what happen when:

(a) Planaria is cut into many pieces
(b) Buds are formed on the notches of the bryophyllum leaf
(c) Pollen grains fall on the stigma of the flower
(d) Egg fuses with the sperm.
(e) Testosterone is released in male humans.

22. Draw a diagram of human eye. Label the following parts and give their functions- pupil, eye lens, ciliary muscles, retina and optic nerve.

23. (a) Demonstrate an activity with a well labelled diagram to prove that white light is made up of seven colours.

(b) List any two natural phenomenon based on scattering of light.

24. (a) Define magnification by a spherical mirror and express it in terms of object distance and image distance for the mirror.

(b) The magnification produced by a convex lens is -2. What is meant by this statement? Write the information regarding image obtained from it?

SECTION-B

25. After performing saponification reaction, Rupal dipped half strip of red litmus paper in the resulting mixture. Which of the following is correct observation?
26. Which of the following chemicals is added during the process of preparation of soap to make it hard and compact?  
   (a) Sodium chloride  
   (b) Sodium sulphate  
   (c) Sodium nitrate  
   (d) Sodium carbonate  

27. Name the salt from the following whose presence makes the water hard:  
   (a) calcium hydrogen carbonate  
   (b) potassium chloride  
   (c) sodium carbonate  
   (d) sodium bicarbonate

28. While performing an experiment to determine the focal length of a concave mirror the mirror fell on the floor from a student’s hand and the mirror broke from its centre into two pieces. The student completed the experiment with one piece. The image formed by this minor piece is:  
   (a) at the same position as it would be with the whole mirror.
(b) blurred for all positions of the screen.
(c) of same brightness as with the whole mirror.
(d) closer to the piece of mirror than for the whole mirror.

29. To find the focal length of a concave mirror, four students Ram, Shamim, Kamla and Ruksana obtained the image of the window grill on a wall. They measured the distance as given below:

<table>
<thead>
<tr>
<th>Student</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ram</td>
<td>between window grill and the wall only</td>
</tr>
<tr>
<td>Shamim</td>
<td>between window grill and the mirror only</td>
</tr>
<tr>
<td>Kamla</td>
<td>between mirror and wall only</td>
</tr>
<tr>
<td>Ruksana</td>
<td>between window grill and wall and also between the mirror and the wall</td>
</tr>
</tbody>
</table>

Who obtained the correct focal length?
(a) Ram (b) Shamim (c) Kamla (d) Ruksana

30. While performing the experiment on tracing the path of a ray of light passing through a rectangular glass slab as shown in the figure, four students interpreted the result as given below. The correct interpretation is:

(a) $\angle i > \angle e > \angle r$
(b) $\angle i > \angle r > \angle e$
(c) $\angle i = \angle e < \angle r$
(d) $\angle i = \angle e > \angle r$

31. While doing the experiment to trace the path of rays of light through a glass prism, a student draws the outer boundary of prism on the drawing sheet. This is done to:

(a) readjust the prism to same position if it gets displaced while doing experiment.
(b) to find out the size of prism.
(c) to find out the angle of deviation.
(d) to find out the angle of incidence.

32. If the leaves of Plant A can be structurally replaced by the tendrils of Plant B, the relation between the leaves and tendrils can be categorized as:
   (a) homologous  (b) analogous  
   (c) rudimentary  (d) histologous

33. The area between the radicle and the place of origin of the cotyledon is termed as:
   (a) Hypocotyl  (b) Radicle
   (c) Plumule  (d) Micropyle

34. When acetic acid is added to a solution of substance ‘X’, a colourless and odourless gas ‘Y’ is formed. The gas ‘Y’ turns lime water milky. Identify ‘X’ and Y. Write a balanced chemical equation for the reaction.

35. You observe a permanent slide of amoeba showing binary fission under a microscope, illustrate it diagrammatically.

36. A 2.0 cm long object is placed perpendicular to the principal axis of a convex lens of focal length 10 cm. If the distance of the object from the lens is 20 cm then draw a neat diagram to show the nature and position of the image.
ANSWERS
SUMMATIVE ASSESSMENT-II (2014-15)
SCIENCE
Class-X
SECTION-A

1. No free electron/No charged particles formed.  

2. To transfer nutrition from the mother’s blood to the embryo  

3. Used in making huts and basket  

4. At the time of sunrise and sunset near the horizon, most of the blue light of shorter wavelengths is scattered away by the particles. Therefore, the light that reaches our eyes is of longer wavelengths. This gives rise to the reddish appearance.  

5. Improper waste disposal causes air pollution, soil pollution, water pollution, cause harmful effects on all living, things.  

6. Grass → Insects → Frogs → Snakes → Eagles  

7. (a) 18  
   (b) Eight  
   (c) Complete Octet  
   (d) He, Ne, Ar (Any Two)  

8. (a) Sodium -Na  
   Magnesium- Mg  
   Silicon - Si  
   (b) Three shells  
   Valence electron shell M shell  

<table>
<thead>
<tr>
<th></th>
<th>K</th>
<th>L</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Na</td>
<td>2,</td>
<td>8,</td>
<td>1</td>
</tr>
<tr>
<td>Mg</td>
<td>2,</td>
<td>8,</td>
<td>2</td>
</tr>
<tr>
<td>Si</td>
<td>2,</td>
<td>8,</td>
<td>4</td>
</tr>
</tbody>
</table>
9. (i) A series of compounds in which the same functional group, substitutes hydrogen in a carbon chain
(ii) Molecular mass of $C_5H_{10}$ is more than $C_4H_8$
(iii) $C_3H_6 < C_4H_8 < C_5H_{10}$

10. On moving down in a group the number of shells increases by one at each succeeding element. As a result distance increases between the nucleus and valence shell effective nuclear charge decreases and hence the tendency to form electro positive ion increases.

11. Brother, sister- closely related
Girl has cousin closely related
Girls in 2 generation - have grand parents as common ancestor

12. (a) Asexual reproduction- because single parent gives rise to a new individual.
(b) Fission- division of organism into two equal halves.
Budding-bud formed on the parent body which detaches and grows into a new individual.

13. 

14. (a)(i) Single parent divides into two equal daughter cells
(ii) Single parent body forms multiple spores from the sporangia to form new individuals
(b) creating variations for survival of species

15. When weight is less due to starvation, no change in DNA. Change is not inherited. Change in non reproductive tissue doesn’t pass.

(Explanation)

16. (a) It means that the ratio of speed of light in vacuum to the speed of light in Ruby is 1.71.
(b) (i) Water  (ii) Sapphire
(c) \( R.I = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in sapphire}} \)

\[
1.71 = \frac{3 \times 10^8}{x}
\]

\[
x = \frac{300 \times 10^8}{171}
\]

Speed of light in sapphire = \(1.83 \times 10^8\) m/s

17. (i) \( d = 25 \text{ cm}, \ p = \frac{1}{f} = \frac{100}{25} = 4D \)

(ii) hypermetropia, convex

(iii) It is because that the iris takes some time to expand the pupil to allow more light to enter. Similarly when we enter into bright light iris takes some time to contract the pupil.

18. (a) Resources limited, millions of years for their formation sustainable development, importance of resources, (any three)

(b) To protect and improve the natural environment, social awareness, environmental conservation, eco-friendly approach, value for life, (any three)

19. (i) acetic acid/CH₃COOH

(ii) \( \text{CH}_3\text{COOH} + \text{CHCH}_2\text{OH} \xrightarrow{\text{acid}} \text{CH}_3\text{COOCH}_2\text{CH}_3 + \text{H}_2\text{O} \)

(iii) Esterification

(iv) \( \text{CO}_2 \)

\( 2 \text{CH}_3\text{COOH} + \text{Na}_2\text{CO}_3 \xrightarrow{} 2\text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2 \)

20. Terminal

Constricted

Dwarf

Green pod colour

Yellow seed colour
21. (a) Each part grows into a new organism.
   (b) Fall on the soil and forms new plants.
   (c) Pollen tube is formed for fertilization.
   (d) Fertilization.
   (e) Secondary sexual characters appear.

22. Well labelled diagram Fig 11.1
   The pupil regulates and controls the amount of light entering the eye.
   Eye lens converges light and forms the image.
   Curvature of eye lens can be modified to some extent by the ciliary muscles and hence its focal length can be changed.
   Retina is the light sensitive screen on which image is formed in an eye. The eye lens forms an inverted real image of the object on the retina. The retina is a delicate membrane having enormous number of light-sensitive cells. The light-sensitive cells get activated upon illumination and generate electrical signals. These signals are sent to the brain via the optic nerves.

23. (a) Activity 11.2 NCERT Book page 193
    Fig 11.5 NCERT Page 193
    (b) (1) Blue colour of sky.
    (2) Red colour of sky at sunrise and sunset.

24. (a) Definition of magnification, Explanation.
    (b) \[ m = \frac{h_2}{h_1} = -2 \]
    \[ h_2 = -2h_1 \]
    The size of image is two times the size of object 2ve sign shows the image is inverted and real

SECTION - B

25  (d)  1
26  (d)  1
27  (a)  1
(a) Hypocotyl

X sodium bicarbonate

Y carbon dioxide gas

\[ \text{CH}_3\text{COOH} + \text{NaHCO}_3 \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2 \]

Fig 8.1 Page-129 NCERT book

Nature of image real and inverted

Position of image 20 cm (2F)

Correct diagram