



## CLASS : 8 SCIENCE

| CLASS : 8 1 <sup>st</sup> MID TERM PORTIONS AND PATTERNS                                           |        |                       |
|----------------------------------------------------------------------------------------------------|--------|-----------------------|
| MEASUREMENT                                                                                        | MATTER | MICROORGANISMS        |
| I. Choose the correct answer                                                                       |        | 5 x 1 = 5             |
| II. Fill in the blanks                                                                             |        | 6 x 1 = 6             |
| III. Match the following                                                                           |        | 5 x 1 = 5             |
| IV. Answer the following (pick out, spot the error; complete the table, diagrams, problems, q & a) |        | 12 x 1 = 12           |
| V. Answer the detail                                                                               |        | 2 x 5 = 10            |
|                                                                                                    |        | <b>Total 50 marks</b> |

| CLASS : 8 2 <sup>nd</sup> MID TERM PORTIONS AND PATTERNS                          |                  |                       |
|-----------------------------------------------------------------------------------|------------------|-----------------------|
| HEAT                                                                              | ATOMIC STRUCTURE | BODY MOVEMENTS        |
| I. Choose the correct answer                                                      |                  | 10 x 1 = 10           |
| II. Short Answers: (pick out, spot the error; assertion and reasoning, who am i?) |                  | 5 x 2 = 10            |
| III. Match the following                                                          |                  | 5 x 1 = 5             |
| IV. Answer in brief (diagram, distinguish, problems, Q and A)                     |                  | 3 x 5 = 15            |
| V. Answer the detail                                                              |                  | 2 x 5 = 10            |
|                                                                                   |                  | <b>Total 50 marks</b> |

| CLASS : 8 3 <sup>rd</sup> MID TERM PORTIONS AND PATTERNS                                                                |       |                       |
|-------------------------------------------------------------------------------------------------------------------------|-------|-----------------------|
| SOUND                                                                                                                   | WATER | ACID AND BASES        |
| I. Choose the correct answer                                                                                            |       | 10 x 1 = 10           |
| II. Answer the following (any 10)                                                                                       |       | 10 x 1 = 10           |
| (Match the following; say True or False; Assertion and Reasoning; Short answers; Pick out the odd one and give reasons) |       |                       |
| III. Answer the following (internal choice)                                                                             |       | 5 x 2 = 10            |
| IV. Answer any three questions (diagrams, Give reasons)                                                                 |       | 4 x 5 = 20            |
|                                                                                                                         |       | <b>Total 50 marks</b> |



## Class: 8 KEY ANSWERS

### Chapter - 1 MEASUREMENTS

#### I. Choose the best answer:

- c – FPS
- a – base
- c – kelvin
- a – directly proportional to the number of atoms
- c – visible light
- b – ammeter
- a – International System of Units
- b – precision
- b – derived quantities
- a – Approximation gives accurate value
- d – luminous intensity
- c – 5.0
- c – atomic clock

#### II. Fill in the blanks:

- |                |                 |
|----------------|-----------------|
| 1. steradian   | 6. solid angle  |
| 2. Scientists  | 7. electronic   |
| 3. temperature | 8. error        |
| 4. Ammeter     | 9. Accuracy     |
| 5. One mole    | 10. plane angle |

#### III. State True or False. If false, correct the statement:

- True
- False – Temperature is a measure of average kinetic energy of the particles in a system.
- False – In thermometers, boiling point of water is taken as the Upper Fixed Point.
- False – One coulomb of charge flowing per second is called ‘ampere’.

- True
- True
- True
- False – Atomic clocks are used in GPS devices.
- False – Candela is used to express luminous intensity.
- True

#### IV. Match the following:

- |      |      |      |
|------|------|------|
| 1. b | 3. d | 5. c |
| 2. e | 4. a |      |

#### V. Consider the statements labelled as Assertion and Reason and choose the correct option:

- (b) Both assertion and reason are true but reason is not the correct explanation of the assertion.

Correct Explanation: In SI systems the units are precisely defined and have the same value everywhere.

- (a) Both assertion and reason are true and reason is the correct explanation of the assertion.
- (d) Assertion is false, but reason is true.

Correct Explanation: Radian is the unit of plane angle.

- (a) Both assertion and reason are true and reason is the correct explanation of the assertion.

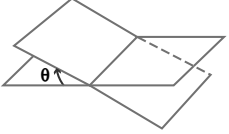
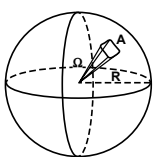
#### VI. Answer in a word or two:

- |                                   |                           |
|-----------------------------------|---------------------------|
| 1. Pound                          | 4. Candela (cd)           |
| 2. Seven                          | 5. $6.023 \times 10^{23}$ |
| 3. Thermometer                    |                           |
| 6. Periodic vibrations            |                           |
| 7. Analog clock and digital clock |                           |

8. One time
9. 60 minutes = 1 hour; 1 minute =  $1/60 = 0.0167$  hours
10. A photometer is used to measure the intensity of light produced by an unknown source in terms of a standard source.

## VII. Answer briefly:

1. Measurement is the process of finding an unknown physical quantity by using a standard quantity.
2. Some common systems of measurement are:  
FPS – Foot for length, Pound for mass and Second for time.  
CGS – Centimeter for length, Gram for mass and Second for time.  
MKS – Metre for length, Kilogram for mass and Second for time.
3. Temperature is a measure of the average kinetic energy of the particles in a system. The SI unit of temperature is kelvin (K).
4. One ampere is defined as one 'coulomb' of charge moving in a conductor in one second.  
 **$1\text{ A} = (1\text{ C})/(1\text{ s})$**
5. Electric current refers to the rate of flow of electric charges passed in a given point in the circuit. The SI unit of current is ampere (A).
6. The measure of the power of the emitted light from a light source in a particular direction per unit solid angle is called luminous intensity. The unit of luminous intensity is candela (cd).
7. Mole is defined as the amount of substance, which contains  $6.023 \times 10^{23}$  particles (atoms, molecules or ions).
8. Plane Angle Vs Solid Angle:

| Plane Angle                                                                                                                                   | Solid Angle                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Angle between the intersection of two lines or planes.<br> | Angle between the intersections of three or more planes at a common point.<br> |

|                        |                          |
|------------------------|--------------------------|
| It is two dimensional. | It is three dimensional. |
| Unit is radian (rad).  | Unit is steradian (sr).  |

9. Measurement is the base of all experiments in science and technology. The value of every measurement contains some uncertainty. These uncertainties are called '**errors**'.

## 10. Accuracy Vs Precision:

|                                                                                    |                                                                       |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| Accuracy refers to the closeness of a measured value to a standard or known value. | Precision is the closeness of two or more measurements to each other. |
|------------------------------------------------------------------------------------|-----------------------------------------------------------------------|

## VIII. Answer in detail:

1. Base quantities are also called fundamental quantities. They are as follows:

| Quantity            | Unit     | Symbol |
|---------------------|----------|--------|
| Length              | Metre    | m      |
| Mass                | Kilogram | kg     |
| Time                | Second   | s      |
| Temperature         | Kelvin   | K      |
| Electric Current    | ampere   | A      |
| Amount of Substance | Mole     | mol    |
| Luminous Intensity  | candela  | cd     |

## 2. Types of clocks: Based on Display

| Analog Display                                                                                                                                                                                                                                                                                                                                                                                         | Digital Clock                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| An analog clockface has numbers from 1 to 12 written around the perimeter of the clockface. Time is read with the help of the 'hands' of the clock.<br><br>A classic analog clock usually has three hands.<br><br><b>Hours hand:</b><br>The hour hand is the shortest and thickest among the three hands. The number that the hour hand points at denotes the hour. It makes one rotation in 12 hours. | A digital clock (also called electronic clock) displays the time digitally, in numbers or symbols.<br><br>• Most digital clocks show the hour in the 24-hour format.<br>• Some are in or can be changed to the 12-hour format too.<br>• They are sometimes battery-run or directly connected to an electric power supply. |

**Minutes hand:**

It is long and thin and points towards the minute. Some clocks only have minute and hour hands. It makes one rotation in one hour.

**Seconds hand:**

It is usually the longest or of the same size of the minute hand and is the thinnest among the three. It makes one rotation in one minute.

- Some advanced digital clocks show date, time, month, year, temperature, humidity etc.

Types of clocks: Based on Mechanism

| Quartz clock                                                                                                                                                                                                                                                        | Atomic Clock                                                                                                                                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| These clocks are activated by 'electronic oscillations', which are controlled by a 'quartz crystal'.                                                                                                                                                                | These clocks make use of the periodic vibrations occurring within an atom.                                                                            |
| Quartz crystals maintain a precise frequency standard, which helps to regulate the movement of a watch or clock, thus making the timepieces very accurate. Quartz is also used in radios, microprocessors and many other technological and industrial applications. | Atomic clocks are used in Global Positioning System (GPS), Global Navigation Satellite System (GLONASS) and International time distribution services. |
| These clocks have an accuracy of one second in every $10^9$ seconds.                                                                                                                                                                                                | These clocks have an accuracy of one second in every $10^{13}$ seconds.                                                                               |

3. **Fundamental quantities:** Physical quantities that cannot be expressed in terms of any other quantities are called fundamental quantities. E.g.: Length, mass, time etc.

**Derived quantities:** Physical quantities that can be expressed by multiplication or division of fundamental quantities are called derived quantities. E.g.: Area, speed, force etc.

4. a. **Electric current:** Rate of flow of charges in a conductor or the amount of electric charges flowing through a conductor in one second is called electric current. SI unit of electric current is ampere (A).

$$\text{Electric current } (I) = \frac{\text{amount of electric charges } (q)}{\text{time } (t)}$$

- b. **Radian:** It is the angle subtended at the centre of a circle, by an arc, whose length is equal to the radius. 1 radian =  $57.27^\circ$
- c. **Steradian:** It is the solid angle made at the centre of a sphere of radius  $r$ , by a portion of its surface of area equal to  $r^2$ .

5.

|                 |                                   |                                  |
|-----------------|-----------------------------------|----------------------------------|
| 4 meters – 4 m  | kilogram – kg                     | cubic centimeter – $\text{cm}^3$ |
| 5 newtons – 5 N | pascal – Pa                       | kilometer – km                   |
| second – s      | square centimeter – $\text{cm}^2$ | kelvin – K                       |

6. Temperature is a measure of the degree of hotness or coldness of a body. The body that gives out heat is said to be at higher temperature than the body that receives heat. Thus, temperature determines the direction of flow of heat. If there is no transfer of heat between the two bodies placed in contact, they are said to be at the same temperature. A thermometer is a device used to measure the temperature of a body.

**IX. Solve the numerical:**

1. Given: Length of the wire ( $l$ ) = 1 mm ; Charge ( $q$ ) = 2 C; Time ( $t$ ) = 0.5 s

We know:

$$\begin{aligned} \text{Electric current } (I) &= \frac{\text{amount of electric charges } (q)}{\text{time } (t)} \\ &= \frac{2}{0.5} = 4 \text{ A} \end{aligned}$$

2. a) If the last digit in 2.864 is less than 5, then remove the last digit.

Therefore, the answer is 2.86.

- b) If the last digit in 4.868 is 5 or more and the second to the last digit in 4.868 is less than 9, then remove the last digit and add 1 to the second to the last digit. Therefore, the answer is 4.87.

**X. Higher Order Thinking Skills (HOTS):**

- No, it is not possible to have 100° C fevers. The normal temperature of human body is 98.4° F to 98.6° F. So, my friend should say that he was affected by a fever of 100° F and it is not 100° C.

**Chapter - 2 FORCE AND PRESSURE****I. Choose the best answer:**

- c – move with a decreased speed
- c – both (a) and (b)
- d – both (a) and (b)
- a – 76 cm of mercury column
- a – Grease
- b – poise

**II. Fill in the blanks:**

- increases
- Pascal's Law
- surface tension
- Torricelli

**III. Match the following:**

| Match: I | Match: II |
|----------|-----------|
| 1. e     | 1. b      |
| 2. c     | 2. d      |
| 3. b     | 3. e      |
| 4. a     | 4. a      |
| 5. d     | 5. c      |

**IV. State True or False. If false, correct the statement:**

- True
- True
- True
- True
- False – Rolling friction < Sliding friction < Static friction
- False – When energy is transformed from one form to another, or moved from one place to another, or from one system to another there is energy loss.

7. True

8. True

- False – Viscosity is normally independent of pressure, but liquids under extreme pressure often experience an increase in viscosity. Since liquids are normally incompressible, an increase in pressure doesn't really bring the molecules significantly closer together.

**V. Arrange the following in the increasing order:**

- Rolling friction < Sliding friction < Static friction
- Cotton cloth, paper, card board, silver plate, glass plate.

**VI. Complete the analogy:**

- Knot in a thread : static friction; Ball bearing : rolling friction
- Buoyancy

**VII. Solve the numerical:**

- Given: weight of a stone (W) = 500 N = F

$$\text{Area (A)} = 25 \text{ cm}^2 = 25 \times 10^{-4} \text{ m}^2$$

$$\text{Pressure (P)} = \frac{F}{A} = \frac{500}{25 \times 10^{-4}} = 2 \times 10^5 \text{ Pa}$$

**VIII. Consider the statements labelled as Assertion and Reason and choose the correct option:**

- (a) Both assertion and reason are true and reason is the correct explanation of the assertion.
- (b) Both assertion and reason are true but reason is not the correct explanation of the assertion.

Correct Explanation: The weight of the bags fall on larger area of shoulder. So, lesser pressure is produced.

- (b) Both assertion and reason are true but reason is not the correct explanation of the assertion.

Correct Water strider slides easily due to the surface tension of water.

### IX. Answer in a word or two:

1. a) When a lump of chapatti dough is pressed, pushed and pulled, we see the shape of the dough changing.  
b) If you pull the two ends of a rubber band, it gets stretched.
2. Example 1: Lifting a book lying on the table.  
Example 2: Kicking a football at rest.
3. Pascal's Law (applying pressure).
4. The nail becomes hot due to friction. Friction changes kinetic energy to heat.
5. Friction arises due to the interlocking of the irregularities of the two surfaces.
6. Barometer, Manometer, Pressure gauge etc.
7. One atmosphere is the pressure exerted by column of air on the ground at sea level.
8. Broader straps are provided on a back-pack for giving less pressure on the shoulders by providing a large area of contact with the shoulder.
9. In plants water molecules are absorbed by the roots and the xylem tissue vessels help the water rise upward due to capillary action, which is caused by the surface tension of the water.
10. Honey has greater viscosity.

**Reason:** Thicker liquids are more viscous than thinner liquids. As honey has greater viscosity, more frictional force will be acting on it. (Or) The resistance offered by honey to any kind of change or deformation is greater than oil.

### X. Answer briefly:

1. Frictional force is the force that resists or opposes the motion of an object. It exists at the surface of contact between two bodies, when at least one of them is in motion.

#### Examples:

- i. Friction helps to fire match stick using match box.
- ii. Friction is necessary for walking and running.

2. **By using lubricants:** Lubricants like oil and grease are used in engines and moving parts of machines to reduce friction. Lubricants fill up the gaps in the irregular surfaces between the bodies in contact. This provides a smooth layer thus preventing a direct contact between their rough surfaces.

#### With the help of polishing the surface:

We sprinkle fine powder on the carrom board and then we polish its surface to make smooth, so that the striker slides easily on the surface.

#### By using ball bearings:

Since the rolling friction is smaller than sliding friction, sliding is replaced by rolling with the usage of ball bearings. Ball bearings are used for smooth rotation of wheels, fans and motor pumps.

3. Pascal's law states that the pressure applied at any point of a liquid at rest, in a closed system, will be distributed equally through all regions of the liquid.

#### Applications of Pascal's law:

- i. In an automobile service station, the vehicles are lifted upwards using the hydraulic lift, which works as per Pascal's law.
  - ii. The automobile brake system works according to Pascal's law.
  - iii. The hydraulic press is used to make the compressed bundles of cotton or cloth so as to occupy less space.
4. The rolling friction is smaller than sliding friction, sliding is replaced by rolling with the use of ball bearings. So, lead shots are used in the bearing of a cycle hub.
  5. During a heavy storm, sailors pour soap powder or oil into the sea near their ship to decrease the surface tension of sea water. This process reduces the impact of the violent water current against the walls of the ship.

### XI. Answer in detail:

1. Friction is a necessity in most of our day to day activities. It is desirable in most situations of our daily life.
  - i. We can hold any object in our hand due to friction.

- ii. We can walk on the road because of friction. The footwear and the ground help us to walk without slipping.
- iii. Writing easily with a pen on paper is due to friction.
- iv. Automobiles can move safely due to friction between the tyres and the road. Brakes can be applied due to frictional resistance on brake shoes.
- v. We are able to light a matchstick, sew clothes, tie a knot or fix a nail in the wall because of friction.

Though it is giving a negative effect, in most of our day to day life friction helps us to make our life easy. So, it is called as “necessary evil”.

### Disadvantages of friction:

We know that due to friction, large amount of useful energy is wasted in the form of heat. This causes wear and tear of machine parts.

- i. Friction wears out the surfaces rubbing with each other, like screws and gears in machines or soles of shoes.
- ii. We also know that due to friction from air, which opposes the movement, fuel is wasted in automobiles.

### 2. Friction can be classified into two basic types:

- i. Static friction
- ii. Kinetic friction.

**Static friction:** The frictional force that exists between the two surfaces so long as they are relatively at rest when an external force acts is called static friction. There is no movement of the body in static friction.

In static friction,  
force of static friction = applied force.

**Kinetic friction:** Friction existing during the motion of bodies is called kinetic friction.

Further, kinetic friction can be classified into two:

- i. Sliding friction
- ii. Rolling friction.

**Sliding friction:** When a body slides over the surface of another body, the friction acting between the surfaces in contact is called sliding friction.

**Rolling friction:** When a body rolls over another surface, the friction acting between the surfaces in contact is called rolling friction. Rolling friction is less than sliding friction. That is why wheels are provided in vehicles, trolleys, suitcases etc.

### 3. Aim: To understand about the frictional force between the layers of liquid in motion.

#### Materials required:

- Different kinds of liquids – coconut oil, honey, water and ghee,
- Glass plates – four in number

#### Procedure:

- i. Take a small quantity of different kinds of liquid like coconut oil, honey, water and ghee in a cup.
- ii. Place one drop of each liquid on a separate glass plate.
- iii. Next, gently raise one end of the glass plate, one by one, so as to allow the liquid to slide down the smooth surface of the plate.
- iv. Observe the speed of each liquid.

#### Observation:

Each liquid moves with a different speed. Water flows faster than other liquids. Coconut oil and honey flows with a moderate speed. Ghee flows very slowly.

#### Inference:

Between the layers of each liquid in motion, there is a frictional force parallel to the layers of the liquid. This frictional force opposes the motion of the liquid layers while they are in motion.

### 4. Friction can be minimised:

- i. with decrease in surface area of contact between two bodies.
- ii. with decrease in mass of the body.
- iii. with decrease in speed of the body.
- iv. when surface of contact between the two bodies is smooth.

**By using lubricants:** Lubricants like oil and grease are used in engines and moving parts of machines to reduce friction. Lubricants fill up the gaps in the irregular surfaces between the bodies in contact. This provides a smooth layer thus preventing a direct contact between their rough surfaces.

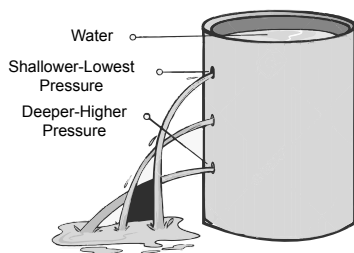
**With the help of polishing the surface:** We sprinkle fine powder on the carrom board and then we polish its surface to make smooth, so that the striker slides easily on the surface.

**By using ball bearings:** Since the rolling friction is smaller than sliding friction, sliding is replaced by rolling with the usage of ball bearings. Ball bearings are used for smooth rotation of wheels, fans and motor pumps.

5. Take an empty container made of plastic. Keep it on a horizontal table surface. Make holes at different heights of the bottle. Now pour some water into it and let it flow through the holes. It is observed that water jets out from these holes.

#### Inference:

Observe how the water is flowing out. The water comes out from all the holes with varied forces and falls on the table at distances that are at different distances from the bottle. Water from the lowest hole comes out with the greatest force and falls at a point that is at the maximum distance from the bottle. Water from the topmost hole comes out with the least force and falls at the point that is at the minimum distance from the bottle.



This concludes that liquid pressure at a point increases with the increase of depth of point from the free surface.

## XII. Higher Order Thinking Skills (HOTS):

1. Given dimensions of the brick are:  
Mass = 2.4 kg, length = 30 cm, breadth = 12 cm and height = 10 cm.

- a) Force = mass  $\times$  acceleration due to gravity  
 $F = ma = 2.4 \times 9.8 = 23.52 \text{ N}$
- b) Pressure exerted when the broader side is in contact with ground  
= Force exerted by the brick on the ground  $\div$  area of contact ( $0.3 \text{ m} \times 0.12 \text{ m}$ )  
= 653.33 Pa
- c) Pressure exerted when the narrower side is in contact with ground  
= Force exerted by the brick on the ground  $\div$  area of contact ( $0.3 \text{ m} \times 0.1 \text{ m}$ )  
= 784 Pa
2. Fountain pens are built in such a way that the pressure inside them balances the atmospheric pressure at sea level. Since atmospheric pressure decreases with an increase in height above sea level, the pressure inside the pen turns out to be much greater than the air pressure in an aeroplane and the pen starts leaking.
3. Yes, tribometre is a special device used to measure the magnitude of friction directly.
4. Mercury is commonly used in barometers because of its high density (13.6 g/cc) means height of the column can be a reasonable size to measure atmospheric pressure. Whereas, the density of water is 1 g/cc and a barometer using water, would need to be 13.6 times taller than a mercury barometer to obtain the same pressure difference. That is why; it is difficult to construct a water barometer.  
  
Note: The atmospheric pressure is equivalent to 0.76 m of mercury column and the height of the water column will be around 10 m ( $13 \times 0.76 \text{ m}$ ).
5. At higher altitudes the atmospheric pressure is very low when compared to the blood pressure which caused the blood vessels to burst and as a result the nose bleeds.
6. We know that the atmospheric pressure is equivalent to 10 m of water column and pressure increases with depth. So the pressure at depth, 'd', of water is (10 + d) of water column. It is given the volume of bubble is inversely related to pressure.

Therefore,  $r^3 \propto \frac{1}{p}$  where 'r' is the radius and 'p' is the pressure.

Initial radius:  $r_1$  and final radius:  $3r_1$

$$27 \frac{r_1^3}{p_1^3} = \frac{(10 + d)}{10}$$

Therefore,  $d = 260$  m.

## Chapter - 3 LIGHT

### I. Choose the correct answer:

1. b – spherical mirrors
2. b – concave mirror
3. b – centre of curvature
4. b – convex mirror
5. c – principal axis
6. b – focal length
7. c – radius of curvature
8. c – 20 cm (Since,  $R = 2F = 2 \times 10 \text{ cm} = 20 \text{ cm}$ )
9. d – at C
10. b – 1.33

### II. Fill in the blanks:

1. concave mirror
2. pole
3. smaller, virtual and erect
4. concave mirror
5.  $45^\circ$
6. infinity

### III. Match the following:

| Match: I | Match: II |
|----------|-----------|
| 1. c     | 1. b      |
| 2. a     | 2. c      |
| 3. d     | 3. d      |
| 4. b     | 4. a      |

### IV. Answer briefly:

1. Mirrors in which curved reflecting surface forms a part of a sphere are called spherical mirrors.

2. Given: radius of curvature (R) = 25 cm

$$\text{Focal length (f)} = \frac{\text{radius of curvature}}{2} = \frac{R}{2} = \frac{25}{2} = 12.5 \text{ cm}$$

### 3. Applications of concave mirror:

- i. **As a shaving mirror:** When a concave mirror is held near the face (that is the face is between the pole and the focus of the mirror), the image will be erect and magnified. This makes it easier to see tiny facial hair.
- ii. **As a reflector:** In torches, search lights and headlights of vehicles, the lamp is placed at the focus of the concave reflector so that the reflected light will reach larger distances.

### Applications of convex mirror:

- i. **As rear view mirror in vehicles:** The image formed by a convex mirror is always small, virtual and erect. This enables the driver to see all the traffic approaching from behind. A plane mirror can also be used for this purpose but the field of view is greater for a convex mirror compared to the plane mirror of the same size.
- ii. Convex mirrors are used in roads, parking lots of shopping malls, hallways etc. where there are sharp turns; so that an observer can see the vehicles or people approaching even from a faraway distance, from the other side of the turn.

4. **Given:** angle of inclination ( $\theta$ ) =  $45^\circ$

$$\begin{aligned} \text{Number of images} &= \frac{360}{\text{angle of inclination}} - 1 \\ &= \frac{360}{45} - 1 = 7 \end{aligned}$$

5. **(a) Convex mirror:** A convex mirror is made by silvering the inner surface of the hollow sphere such that the reflection takes place from the outer (or bulging) surface. The image

formed by these mirrors is smaller than the object.

**(b) Concave mirror:** A concave mirror is made by silvering the outer (or bulging) surface of the piece of a hollow sphere such that the reflection takes place from the hollow (or concave) surface. These mirrors magnify the object placed close to them.

6. **(a) Focal length:** The distance between the pole and the principal focus is called focal length ( $f$ ) of a spherical mirror. The focal length is half of the radius of curvature ( $R$ ).

**(b) Radius of curvature:** It is the distance between the pole and the centre of curvature. It is denoted by the symbol  $R$ .

7. Image formed by convex mirror placed at different positions is as follows:

| Position of the Object                                      | Position of the Image                 | Size of the Image              | Nature of the Image |
|-------------------------------------------------------------|---------------------------------------|--------------------------------|---------------------|
| At infinity ( $\infty$ )                                    | At the focus $F$ , behind the mirror  | Highly diminished, point-sized | Virtual and erect   |
| Behind infinity ( $\infty$ ) and the pole $P$ of the mirror | Between $P$ and $F$ behind the mirror | Diminished                     | Virtual and erect   |

8. Kaleidoscope is a device that functions on the principle of **multiple reflection** of light to produce numerous patterns of images. It has two or more mirrors inclined with each other. It can be designed from inexpensive materials, and the colourful image patterns formed is very beautiful and interesting to observe. This instrument is used as a toy for children.
9. When a ray of light falls normally on the surface of the mirror, then the angle of incidence and the angle of reflection for such a ray of light will be zero. This ray of light will be reflected back along the same path. This is called normal reflection.

10. (a) When a light ray travels from a **rarer medium to a denser medium**,

- the speed of light decreases.
- the light ray bends towards the normal.
- the angle of refraction  $<$  angle of incidence.

- (b) When a light ray travels from a **denser medium to rarer medium**,

- the speed of light increases.
- the light ray bends away from the normal.
- the angle of refraction  $>$  angle of incidence.

#### 11. Effects of refraction of light:

- A pencil dipped in water in a glass appears to be bent at the interface of air and water due to refraction of light.
- Swimming pool looks shallower than the reality as the light coming from the bottom of the pool bends when it comes out at the surface due to refraction of light.

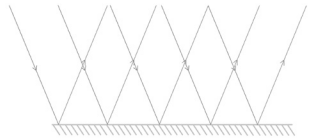
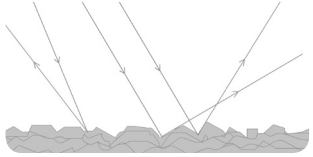
#### V. Answer in detail:

1. The image formed by a concave mirror can be real or virtual depending on the position of the object. The following table shows the nature, position and relative size of the image formed by a concave mirror.

| Position of the Object | Position of the Image | Size of the Image              | Nature of the Image |
|------------------------|-----------------------|--------------------------------|---------------------|
| At infinity            | At the focus $F$      | Highly diminished, point-sized | Real and inverted   |
| Beyond $C$             | Between $F$ and $C$   | Diminished                     | Real and inverted   |
| At $C$                 | At $C$                | Same size                      | Real and inverted   |
| Between $C$ and $F$    | Beyond $C$            | Enlarged                       | Real and inverted   |
| At $F$                 | At infinity           | Highly Enlarged                | Real and inverted   |
| Between $P$ and $F$    | Behind the mirror     | Enlarged                       | Virtual and erect   |

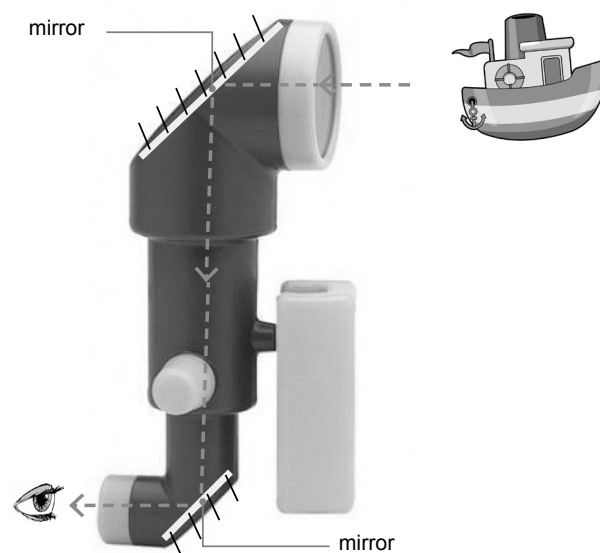
2. **Reflection:** The bouncing back of the light rays as they fall on the smooth, shiny and polished surface is called reflection.

### Regular reflection Vs Irregular reflection:

| Regular Reflection                                                                                                                                                                                                                                              | Irregular Reflection                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| When the reflecting surface is smooth or polished, as in a mirror, the laws of reflection will be obeyed. If a parallel beam is incident, the reflected beam is also parallel and the reflected ray takes a definite path. This is known as regular reflection. | When a parallel beam is incident on a rough surface, like a wall, paper, wood, a dull metal, etc., the reflected beam is not parallel. The rays of the beam after reflection move randomly in different directions. Thus, the reflected rays do not follow a definite pattern. This type of reflection is called irregular or diffused reflection. |
|                                                                                                                                                                              |                                                                                                                                                                                                                                                                 |

### 3. Working of a periscope:

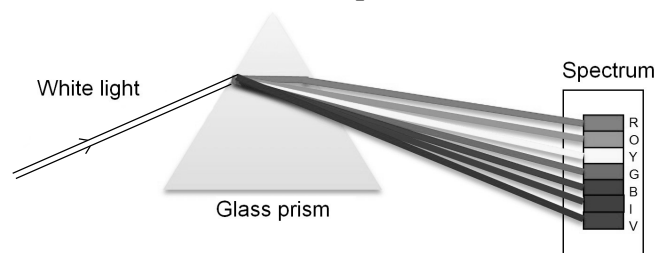
- This contains a hollow cardboard or wooden tube, which is bent twice at right angles in opposite directions as shown in the figure.
- Two plane mirrors are fixed at the two bends such that they make an angle of  $45^\circ$  with the frame of the tube. The reflecting faces of the two mirrors face each other.
- Rays of light moving parallel to the top limb are incident at an angle of  $45^\circ$  on the first mirror.



Periscope model

- The reflected rays move parallel to the vertical portion of the tube and are incident again on the second mirror at the same angle.
- After reflection from the second mirror, the rays move parallel to the bottom limb of the tube. Thus, a periscope can be used to see objects behind an opaque obstruction.
- It is used in warfare and in the navigation of submarines. In the military it is used for pointing and firing guns from a 'bunker'.

4. **Dispersion:** The splitting of white light or sunlight into its seven constituent colours is called dispersion. The phenomenon was discovered by Isaac Newton, and the display of colours is known as a **spectrum**.



- A prism contains two refracting faces inclined at an angle called angle of the prism, which is usually  $60^\circ$ . A ray of white light incident on the prism undergoes refraction at the two faces and comes out as the constituent seven colours namely violet, indigo, blue, green, yellow, orange and red.

- ii. In vacuum or air all the constituent colours of sunlight travel at the same speed, which is  $3 \times 10^8$  m/s.
- iii. In all the other denser media like glass or water, different colours travel at different speeds. Hence different colours deviate or bend to different extents and thus get separated.
- iv. When a ray of white light is incident on one face of the prism, the angle of incidence remains same but the angles of refraction for different colours will be different.
- v. Red colour deviates or bends to a minimum extent and violet to the maximum extent. This means, inside the glass, red-light travels slowest and violet travels fastest.

5. **Given:** speed of the light in air ( $c$ ) =  $3 \times 10^8$  m/s; refractive index ( $\mu$ ) = 1.5

Speed of the light in medium ( $v$ ) = ?

$$\text{We know that: } \mu = \frac{c}{v} \Rightarrow 1.5 = \frac{3 \times 10^8}{v}$$

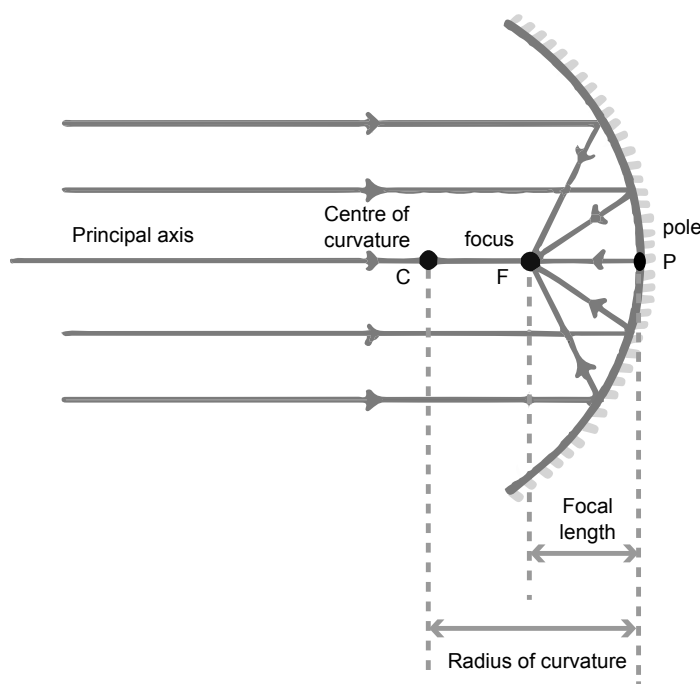
$$\Rightarrow v = 2 \times 10^8 \text{ m/s}$$

6. (a) **Centre of curvature:** Centre of curvature of the mirror is the centre of the sphere of which the mirror is a part. It is denoted by the letter **C**.

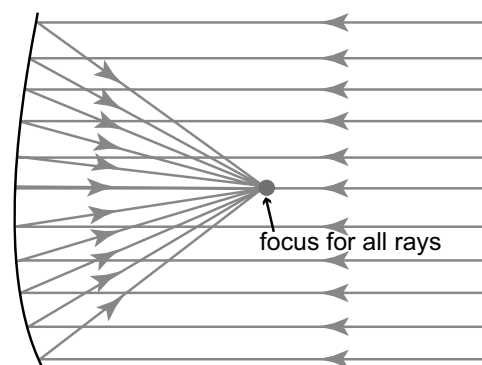
(b) **Pole:** It is the geometric centre of the spherical mirror. It is denoted by the letter **P**.

(c) **Principal axis:** The line passing through the pole of the mirror and its centre of curvature is known as the principal axis. **PC** represents the principal axis.

(d) **Focus:** When a beam of light is incident on a spherical mirror, the reflected rays converge (concave mirror) at or appear to diverge from (convex mirror) a point on the principal axis. This point is called the 'focus' or 'principal focus'. It is also known as the **focal point**. It is usually denoted by the letter **F** (in ray diagrams).



7. Parabolic mirrors are concave mirrors in the shape of a parabola. The first parabolic mirrors were constructed by Heinrich Hertz, a German physicist, in the form of reflector antenna in the year 1888.



Ray diagram of the Parabolic mirror

- i. The concave reflecting surface of the parabolic mirror focuses the incident beam of light to converge at the focal point of the mirror.
- ii. If a light source is kept at the focus point of the parabolic mirror, the reflected light rays will follow the direction parallel to the principal axis of the mirror. This enables the light rays to travel longer distances without the intensity getting diminished.

### Uses of parabolic mirrors:

- i. Parabolic mirrors, also known as parabolic reflectors, are used to collect or project

energy such as light, heat, sound and radio waves.

- ii. They are used in reflecting telescopes, radio telescopes and parabolic microphones.
- iii. Parabolic troughs are used in case of solar panels. These panels are equipped with a tracking mechanism that changes the vertical angle of the trough according to the position of the sun in the sky. Some troughs also contain water in the central tube that gets heated due to the focus of the sun's rays.

### 8. Refractive index:

- i. The refractive index is denoted by the symbol  $\mu$ , (pronounced as mew) generally defined with respect to vacuum or air.
- ii. It is the ratio of the speed of light in vacuum to the speed of light in a medium i.e.

$$\mu = \frac{\text{speed of light in air (c)}}{\text{speed of light in medium (v)}}$$

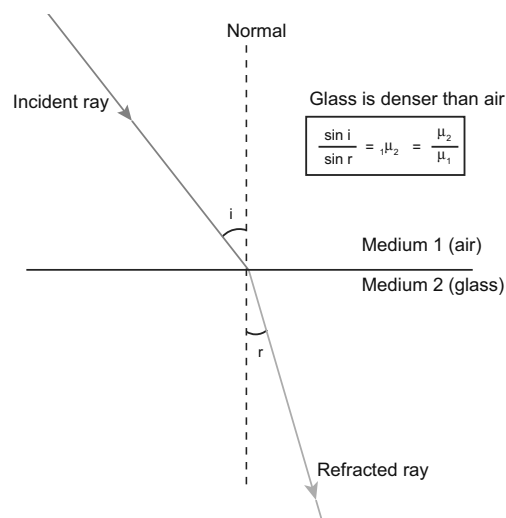
- iii. It is ratio of two similar quantities and doesn't have any units.
- iv. Refractive index of a medium is always greater than 1 as speed of light in medium is always less than in vacuum or air.

9. Refraction of light: The bending of light due to change in its speed, when it travels from one optical medium to another, is called refraction of light.

### Snell's law of refraction:

- i. The incident ray, the refracted ray and the normal at the point of incidence all lie in the same plane.
- ii. The ratio of the sine of angle of incidence (i) to the sine of angle of refraction (r) is equal to the refractive index of the medium 2 with respect to the medium 1 and is a constant.

$$\frac{\sin i}{\sin r} = {}_1\mu_2, \text{ constant}$$



### VI. Higher Order Thinking Skills (HOTS):

1. a. Size of the image is increasing as the object is moving away from the mirror. The magnification is only possible in concave mirror. Since the image is upright, the object is in between pole and focal point.
- b. Convex mirror image is always diminished, upright and decrease size when object moves away from mirror.
- c. In a plane mirror, image distance is always equals the object distance. The size of the image is the same as the object (the mirror does not magnify the image). Also image is always upright.
2. Medium A is optically denser than medium B. A ray bends away from the normal only on entering a rarer medium from a denser medium.

**Note:** Speed of light in rarer medium is more in comparison with speed of light in denser medium.

## Chapter - 4 HEAT

### I. Choose the best answer:

1. c - thermal energy
2. d -All the above
3. d -All the above
4. c - Gas
5. c - freezing
6. a -solid

## II. Fill in the blanks:

1. heat transfer between systems
2. Specific heat capacity
3. the temperature of a system at a constant
4. deposition
5. increase
6. reduce

## III. State True or False. If false, correct the statement:

1. True
2. False - The dimensions increase if the temperature is increased.
3. False - It is called sublimation.
4. False - Convection is the process by which thermal energy flows in liquids.
5. False - It is the product of mass and specific heat capacity.
6. False - In a thermos flask, the silvered walls reflect radiated heat back to the liquid in the bottle.

## IV. Match the following:

- |      |      |      |
|------|------|------|
| 1. e | 3. d | 5. b |
| 2. a | 4. c |      |

## V. Answer briefly:

### 1. Applications of conduction in our daily life:

- i. We cook food in vessels made up of metals. When the vessel is heated, heat is transferred from the metal to the food.
- ii. When we iron dresses heat is transferred from the iron box to the cloth.
- iii. Handles of cooking utensils are made up of plastic or wood because they are poor conductors of heat.
- iv. The temperature inside igloo (snow house) is warm because snow is a poor conductor of heat.

### 2. Effects of heat:

- i. Increase in temperature of an object
- ii. Expansion of an object
- iii. Change in state of an object

3. Convection, Conduction and radiation are the three types of heat transfer.

4. The process of transfer of heat in solids from a region of higher temperature to a region of lower temperature without the actual movement of molecules is called conduction.

5. Convection is the flow of heat through a fluid from places of higher temperature to places of lower temperature by movement of the fluid itself. Convection takes place in liquids and gases (fluids).

6. It is the amount of heat energy required to raise the temperature of unit mass of a substance (1 kg) through 1°C or 1 K. It is denoted by  $c$ . Its units are joule per kelvin per kilogram or J/(kg K). It is independent of mass of the substance. It is given by the formula:  $c = \frac{Q}{m\Delta T}$

7. One calorie is the amount of heat energy required to raise the temperature of 1 gram of water through 1°C.

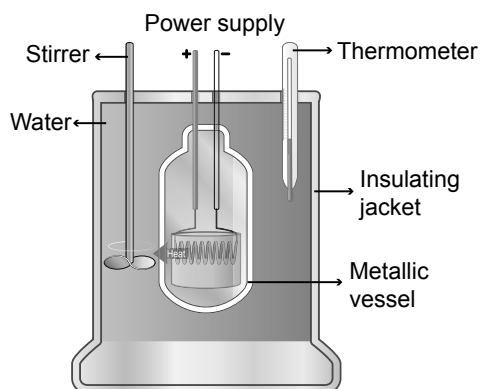
8. We can use a calorimeter to compare the specific heat capacities of two liquids. We can measure the heat capacity of each individually and then compare them.

## VI. Consider the statements labelled as Assertion and Reason and choose the correct option:

1. (d) Assertion is false, but reason is true.  
Correct Explanation: Radiation is the emission or transmission of energy in the form of waves or particles through space or through a material medium.
2. (a) Both assertion and reason are true and reason is the correct explanation of assertion.

## VII. Answer in detail:

1. Calorimetry is a method to measure the heat exchange of process which can be *physical changes* such as melting, evaporation or it can be a *chemical changes* such as acid-base neutralisation. A **calorimeter** is a device designed to measure the amount of heat absorbed or released in a chemical or physical process.



### Parts and working of a calorimeter:

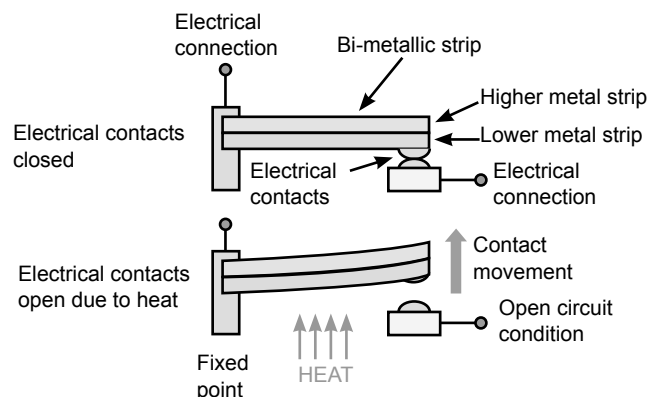
- i. **Metallic vessel:** A vessel made of metals like copper or aluminium which are good conductors of heat and electricity.
- ii. **Insulating Jacket:** The metallic vessel is kept in an insulating jacket to prevent heat loss to the environment. There are two holes in it.
- iii. **Thermometer:** Through one of the holes of an insulating jacket, a thermometer is inserted to measure the temperature of a substance.
- iv. **Stirrer:** It is inserted through another hole of an insulating jacket for stirring the substance taken in the vessel and distributes heat throughout the vessel.
- v. **Power Supply:** The vessel is filled with liquid which is heated by passing current through the heating element. Using this device we can measure the heat capacity of the liquid in the container.

2. Thermostat is a device to detect temperature changes for the purpose of maintaining the temperature of an enclosed area essentially constant. It will automatically cool the room when it is hot and heat it up when it is cold according to a pre-set temperature.

### Working of thermostat:

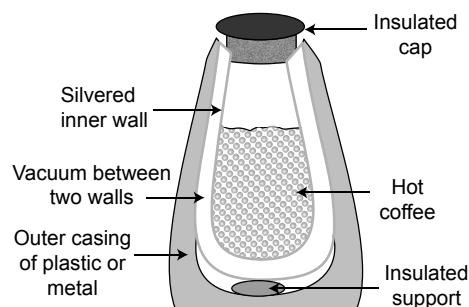
A traditional thermostat uses a bimetallic strip to work. This has two pieces of different metals that are welded together.

- i. In a thermostat, the strip works as a bridge in an electrical circuit connected to it.
- ii. When the strip is straight and connected, the circuit is complete. Hence, the strip carries electricity through the circuit, and the heating is turned on.



Working of the bimetallic strip in a thermostat

- iii. As the temperature of the surroundings increases, the strip gets hot. This causes one of the metals to expand more than the other. This causes the whole strip to bend. This causes the circuit to break, and the electricity switches off.
  - iv. As the room cools, the strip also cools and bends back to its original shape. This makes the electricity flow again, so the heating switches back on.
  - v. By adjusting the temperature dial, we can change the temperature at which the circuit switches on and off.
3. A thermos flask can keep a liquid hot or cold for a long period of time. A thermos flask has three components that help it reduce heat loss through conduction, convection and radiation.



- i. **Insulated cap:** This is an insulator. It prevents heat loss by conduction through the opening of the flask. It also stops any gas from moving out of the flask, reducing heat loss by convection.
- ii. **Outer casing of plastic or metal:** Both plastic and glass are poor thermal conductors. This reduces the heat loss by conduction through the walls. This also holds the vacuum in between to further eliminate the heat transfer by convection and conduction.

iii. **Silver inner wall:** A shiny surface is a poor emitter of radiation. This will avoid the heat transfer through radiation.

4. Radiation is the flow of heat from one place to another by means of electromagnetic waves.

#### **Applications of radiation in daily life:**

- Heat energy from the Sun reaches the Earth by radiation.
- While standing near fire we feel the heat which is transferred as radiation.
- Black surfaces absorb heat radiation so that the bottom of the cooking vessels is painted black.
- While colour reflects heat radiation. That's why we are advised to wear white cloth during summer.

#### **5. (a) Melting Vs Freezing**

| <b>Melting or Fusion</b>                                                                           | <b>Freezing or Solidification</b>                                                                           |
|----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| The process in which a solid is converted to liquid by absorbing heat is called melting or fusion. | The process in which a liquid is converted to solid by releasing heat is called freezing or solidification. |
| The temperature at which a solid changes its state to liquid is called <b>melting point</b> .      | The temperature at which a liquid changes its state to solid is called <b>freezing point</b> .              |

#### **(b) Boiling Vs condensation**

| <b>Boiling or Vaporisation</b>                                                                            | <b>Condensation</b>                                                                               |
|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| The process in which a liquid is converted to vapour by absorbing heat is called boiling or vaporisation. | The process in which a vapour is converted to liquid by releasing heat is called condensation.    |
| The temperature at which a liquid changes its state to gas is called <b>boiling point</b> .               | The temperature at which vapour changes its state to liquid is called <b>condensation point</b> . |

#### **(c) Sublimation Vs deposition**

| <b>Sublimation</b>                                                                                                                | <b>Deposition</b>                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| The process in which a solid is directly converted to gaseous state without going through the liquid state is called sublimation. | The process in which a gas directly converts into solid without passing through the liquid state is called deposition. |
| Heat is absorbed during this process.                                                                                             | Heat is released during this process.                                                                                  |
| Examples: Dry ice (solid CO <sub>2</sub> ), naphthalene balls.                                                                    | Example: Frost formation from water vapour.                                                                            |

#### **VIII. Higher Order Thinking Skills (HOTS):**

1. The main reason that lakes doesn't freeze all the way through is:

- That as we go down till the bottom of the lake the pressure increases. The increase in the pressure increases the temperature as pressure is directly proportional to temperature. Increase in temperature down the lake doesn't create the favourable conditions for freezing of the lake.
- Also as ice is less dense as compared to water that is why ice always floats on water and doesn't settle down at the bottom or that is the reason why the lake doesn't start to freeze from the bottom.

2. b) Steel > Water > Wood

Thermal conductivity is defined as the heat flow per unit time or ability to conduct heat. It is highest in solids, and lower in liquids. However, it is lower in non-metals than in metals. Hence, Option b is correct.

#### **IX. Solve the numerical:**

1. Given: amount of heat required (Q) = 1000 J;  
rise in temperature ( $\Delta T$ ) = 20°C – 0°C = 20°C

Heat capacity,

$$(C) = \frac{\text{the amount of heat energy required}}{\text{rise in temperature}} = \frac{Q}{\Delta T}$$

$$= \frac{1000}{20} = 50 \text{ J/}^\circ\text{C}$$

$$2. \text{ Heat capacity (C)} = \frac{Q}{\Delta T} = 8000 \text{ J/}^\circ\text{C} = 8000 \text{ J/K}$$

$$\text{Specific heat capacity, } c = \frac{Q}{m\Delta T} = \frac{1}{m} \left( \frac{Q}{\Delta T} \right)$$

$$= \frac{8000}{100} = 80 \text{ J/(kg K)}$$

## Chapter - 5 ELECTRICITY

### I. Choose the best answer:

1. a – negative
2. c – electrons
3. b – Energy Source, Wire, Load
4. b – positive
5. d – a protective device for breaking an electric circuit

### II. Fill in the blanks:

1. Transfer of electrons
2. positive
3. Lightning arresters or lightning conductors
4. Electric fuse
5. Series circuit

### III. State True or False. If false, correct the statement:

1. True
2. True
3. True
4. True
5. False – In parallel circuit, voltage remains the same in all components.

### IV. Match the following:

- |      |      |      |
|------|------|------|
| 1. c | 3. a | 5. b |
| 2. d | 4. e |      |

### V. Give reasons for the following:

1. When you rub a glass rod with the silk cloth, electrons are attracted away from the atoms in the glass and transferred to the silk cloth. This leaves the glass rod with more positive than negative charge, so you get a net positive charge.

2. When we comb our hair, the electrons (negative charge) from the atoms in your hair were transferred to the comb. Due to the addition of electrons, the surface of the comb now carries a negative charge. The paper bits are neutral - they carry both positive and negative charges. The extra electrons (negative charges) from the comb attract the positive charge of the paper bits. The attraction is so strong that the paper bits fly and stick to the comb.
3. The leaves of an electroscope diverge because when a glass rod is touched on the metal disc, the charge travels through the metal rod to the leaves. Since, like charge repel, the charge travels till the leaves and then open up as both the leaves have like charges.
4. The connecting rod and leaves in an electroscope are essential conductors (in which electrons are free to move) that aid in the working of the electroscope. Hence, they are made of metals, which are good conductors.
5. During thunderstorms, lightning occurs in the sky. Lightning can discharge its charges onto any tall conductors that are available on Earth's surface. An open umbrella could be the only tall object in an open field whose rod and its supporting wires are made up of metals. Hence, it is not advisable to use an umbrella while crossing an open field during a thunderstorm.

### VI. Consider the statements labelled as Assertion and Reason and choose the correct option:

1. (a) Both assertion and reason are true and reason is the correct explanation of the assertion.
2. (d) Assertion is false, but reason is true.  
Correct Explanation: Lightning is attracted to the tallest tip of a conductor. If the tip of a tree is struck by lightning and a person is standing under the tree, then the current from the lightning may travel down the tree and jump towards the human conductor. Therefore, it is not wise to stand under a tree during a thunderstorm.

### VII. Answer briefly:

1. Rubbing certain materials with one another can cause the built-up of electric charges on the surfaces. So, charges are produced by friction.

**Example:** On brushing hair with a comb, the charges are transferred from the hair to comb due to friction.

2. This process by which excessive electric charge is channeled to the earth is called earthing.
3. The path in which the electrons flow from one terminal to another from a source (battery) is known as an electric circuit.
4. **Uses of electroplating:**
  - i. Preventing iron nails from rusting.
  - ii. Preventing automobile parts made of iron from rusting.
  - iii. To prevent iron bridges from rusting.
5. Differences between static electricity and current electricity:

| Static electricity                                                                                                                                                                                 | Current electricity                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Static electricity is a stationary electric charge, typically produced by rubbing two different materials (to create friction) which causes sparks or crackling or the attraction of dust or hair. | Current electricity has a continuous movement of electrons through electrical conductors (like copper wires).                                                                                                                     |
| Static electricity is an excess of electric charge trapped on the surface of an object.                                                                                                            | It can be stopped or started by opening or closing the circuit connection (through switches). Electric current flows when there is voltage present across a conductor.                                                            |
| <b>Examples:</b> Rubbing feet on the carpet, rubbing a balloon on the head, brushing hair with comb vigorously.                                                                                    | <b>Examples:</b> Current electricity runs through wires at our homes, transfer of electric current through transmission lines which bring electricity from power plants to individual houses, offices, industries, hospitals etc. |

6. A fuse is a simple device that can be connected in a circuit inside any electrical appliance. It is designed to withstand heat up to a certain temperature. When excessive current flows through the fuse, it melts because of the high temperature. When the fuse melts, it opens (or breaks) the circuit to save the device from damage. Hence, materials that have a low melting point are used in fuses. A fuse is made of an alloy of lead and tin.

## VIII. Answer in detail:

1. The transfer of electrons takes place in three ways:

**Transfer by friction:** This method of charging an uncharged body by rubbing it against another body is called charging by friction.

**Example:** While combing hair charges are transferred from the hair to comb due to friction.

**Transfer by conduction:** Charges can be transferred to an object by bringing it in contact with a charged body. This method of transferring charges from one body to other body is called transfer by conduction.

**Example:** When the ebonite rod is rubbed with woolen cloth, electrons from the woolen cloth are transferred to the ebonite rod. Now ebonite rod will be negatively charged.

- i. When it is brought near the paper cylinder, negative charges in the rod are attracted by the positive charges in the cylinder.
- ii. When the cylinder is touched by the rod, some negative charges are transferred to the paper. Hence, the negative charges in the rod are repelled by the negative charges in the cylinder.

**Transfer by induction:** The process of charging an uncharged body by bringing a charged body near to it but without touching it is called induction.

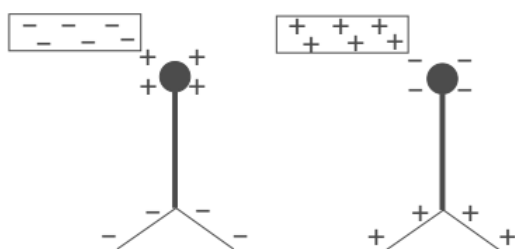
**Example:** We can charge an uncharged object when we touch it by a charged object. But, it is also possible to obtain charges in a body without any contact with other charges like the working of electroscope.

2. Electroscopes are instruments used to detect the presence of electric charges on a body

and measure its magnitude. They are helpful in demonstrating the principles of static electricity and charge interactions.

### Working of electroscope:

- i. When a positively charged material touches the brass disc, it attracts the negatively charged particles on the disc towards itself. This leaves the positively charged particles on the gold leaf. Now, as both the leaves possess the same (positive) charge, they repel each other, making an inverted 'V' shape.

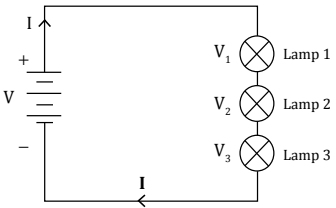
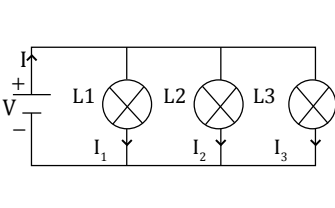


Charge movement in electroscope

- ii. When a negatively charged material touches the brass disc, it attracts the positively charged particles towards it, leaving the negatively charged particles on the leaves. Again, the leaves repel each other as they bear like charges.
- iii. After some time, the leaves come back to their original state because they 'discharge' the charge they bear. When the top disc is touched, it causes a discharge through the human body and brings the leaves back to their original shape. This can also be done by placing a metal rod on the brass disc.
- iv. The process by which electrical discharge can be safely collected away from an electrical device is known as **earthing or grounding**. This also helps the gold leaves from tearing as a result of stretching when they come across highly charged materials.

### 3. Differences between series and parallel circuits:

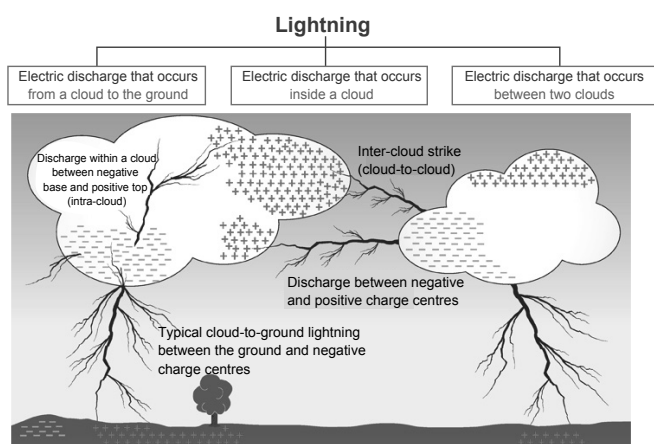
| Series circuits                                                                                         | Parallel circuits                                                           |
|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
| When all the components of a circuit are connected end to end, they are said to be connected in series. | In a parallel circuit, the components are connected parallel to each other. |

|                                                                                                                                                                                                                    |                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| In this arrangement, the electrons will have only one path to flow.                                                                                                                                                | In this arrangement, the electrons can branch out and flow across the circuit.                                                                                                                                               |
| In this type of circuit, the current (I) across each of the components remain the same but the voltage (V) differs.                                                                                                | In this type of circuit, the voltage (V) across each of the components remain the same but the current (I) differs.                                                                                                          |
| The voltage across the circuit is divided across all the devices connected through the circuit. If 'V' is the current across the circuit and the supply voltage is V, it can be written as $V = V_1 + V_2 + V_3$ . | If 'I' is the total of the individual current flowing through the components and $I_1$ , $I_2$ , $I_3$ is the current across each of the components, then, $I = I_1 + I_2 + I_3$ .                                           |
|                                                                                                                                 |                                                                                                                                          |
| As the current flows through a series circuit, the voltage reduces as it flows through each of the components. The lamp at the end of the circuit dims because of the low supply of voltage.                       | When one lamp is defective, it does not affect the whole circuit. The other lamps continue to glow because of the uninterrupted flow of current through the other branches.                                                  |
| Current controlling devices are always connected in series with the device that they protect.<br><b>Example:</b> Fuses are connected in series with the device they protect.                                       | Parallel circuit connection is very common in use.<br><b>Example:</b> Various lamps and electrical appliances in our homes are connected in parallel so that each of the lamps and appliances can be operated independently. |

4. During a thunderstorm, air moves rapidly and carries small ice crystals upward. At the same time, the heavy water droplets from the clouds move downwards. Hence, the upper part of

a storm cloud is positively charged, and the lower part of the cloud is negatively charged.

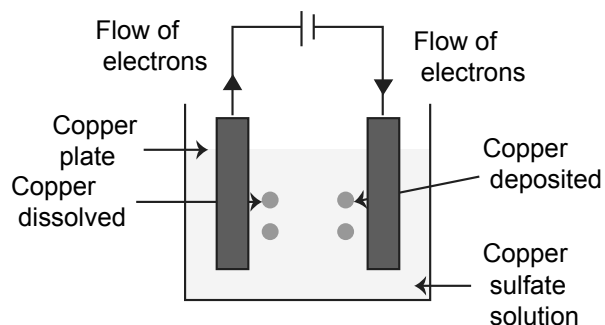
- When the positive and negative charges grow large enough, a giant spark -lightning occurs between the two charges within the cloud. This is similar to static electricity sparks, but much bigger in scale.
- When enough charge is built up in the lower part of the cloud, it meets the accumulated positive charges near mountain tops and trees, causing it to discharge rapidly. This is what we see as flashes of lightning that occur from a cloud to the ground. Thus, lightning can be of three types as shown in the figure below.



5. **Electroplating:** Electroplating is one of the most common applications of chemical effects of electric current. The process of depositing a layer of one metal (usually Zinc) over the surface of another metal by passing electric current is called electroplating.

#### **Explanation:**

- Take a beaker filled with Copper Sulphate ( $\text{CuSO}_4$ ) solution.



- To the positive end of a battery, connect a copper plate.

- To the negative terminal of the battery, connect an iron object, such as a spoon or a plate.
- Dip both the plate and the iron object in the Copper Sulphate solution. Let the current to flow for some time.
- On passing the electric current, electrolysis of the copper sulphate happens. This causes copper ions to be formed.
- The positively charged copper ions are attracted to the negatively charged iron rod. Hence, a thin layer of copper is deposited on the surface of the iron rod.
- The amount of copper deposited on the iron rod is equal to the amount of copper lost from the copper plate.

#### 6. **Effects of electric current:**

- Filament bulb:** The filament in an electric bulb is made of a metal called tungsten. It has very high resistance to conduct electricity. When electricity passes through the filament, it gets heated up. This causes tungsten to glow and emit visible light. Tungsten has a high melting point. This helps it reach higher temperatures without melting.
- Electric cooker:** In electric cookers, the heating coil is placed at the bottom of the cooker. The inner pan is also made of a metal (generally aluminium). The coil is made of high resistant metal. The heat produced in the coil is absorbed through conduction and is used for the process of cooking.
- Electric kettle:** In electric kettles, the heating filament made of highly resistant material is placed at the bottom. The liquid heats up because of the heat produced in the coil.
- Electric irons:** Electric irons also use the principle of heating of a filament due to high resistance. This produces heat energy, which is then conducted to a heavy metal base. The heavy metal base is what presses the clothes. Thus, electrical energy can be transformed into other forms of energy and put to use.

## Chapter - 6 SOUND

### I. Choose the best answer:

1. b – metals
2. c – iii and iv  
Explanation: Pitch of a sound is a sensation depending on frequency and so it is characteristic of frequency and hence vibration. While loudness is related to intensity of sound and hence amplitude, so it is characteristic of vibration. But frequency denotes no of vibrations per second and time period denotes time to complete one vibration. So pitch and loudness are characteristic of vibrations.
3. c – loudness
4. a – string instrument
5. d – violin
6. d – irregular and non-periodic vibrations
7. c – 20 Hz to 20000 Hz
8. a – loudness increases and pitch is higher

### II. Fill in the blanks:

1. vibrating bodies
2. oscillations
3. mechanical waves
4. ultrasonics
5. frequency of the
6. decreases

### III. Match the following:

1. d – frequency more than 20000 Hz
2. c – 330 m/s
3. a – frequency below 20 Hz
4. b – needs material medium

### IV. Answer briefly.

1. Vibration is a to and fro motion of the particles coming from the source
2. The most common example of showing that light travels faster than sound is lightning. Whenever a lightning strikes, we see the lightning first and then hear the thunder after some time.
3. The relation between loudness of a sound and amplitude of the vibration is:

$$\text{loudness} \propto (\text{amplitude})^2$$

So to increase the loudness by 4 times, the amplitude should be increased to the 'square of amplitude'.

4. A sound with a frequency greater than 20000 Hz is called ultrasonic sound.

### 5. Differences between music and noise:

| MUSIC                                                                         | NOISE                                                                                                 |
|-------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| The sounds that are pleasing to the ears are called musical sounds.           | The unpleasant sounds or any unwanted, irritating, louder sound is called noise.                      |
| Music is produced by playing regular patterns of vibrations in an instrument. | It is the sound produced by irregular and non-periodic vibrations.                                    |
| Examples: Music from flute, sitar, harmonium, table.                          | Examples: Bursting crackers, sound of airplanes, busy roads, various household electrical appliances. |

### 6. Health hazards due to noise pollution:

- i. Noise pollution causes stress and irritation.
  - ii. Continuous exposure to noisy environments leads to loss of hearing ability.
  - iii. Sudden exposure to loud noises leads to deafening of the ear and sometimes heart attack too. It alters sleep patterns hugely.
  - iv. Persistent noises lead to lack of concentration while working and it even leads to high blood pressure or short-tempered nature.
7. (a) **Amplitude:** It is the maximum displacement of a vibrating particle from its mean position is called the amplitude. Its units are metres (m).  
(b) **Loudness:** It is the characteristic of a sound that enables us to distinguish between weak and feeble sound from a loud sound. It mainly depends upon the amplitude of sound. Its units are decibels (dB).
  8. Tree parts such as thick branches, leaves and wood effectively absorb sound. By planting a variety of both hedges or shrubs and taller

trees to create a wall of foliage from the ground up. The rough bark and thick, fleshy leaves absorb sound due to their dynamic surface area and reduce sound pollution.

9. Hearing loss is otherwise known as hearing impairment. It is the inability to hear partially or totally. This can happen to one or both the ears.

| Symptoms of hearing loss                                                                                                                                                                                                                                  | Reasons for hearing loss                                                                                                                                                                                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Muffling of speech and other sounds.</li> <li>Need to turn up the volume of the TV or radio.</li> <li>Difficulty in hearing words clearly.</li> <li>The need to ask others to speak loudly and clearly.</li> </ul> | <ul style="list-style-type: none"> <li>Ageing.</li> <li>Continuous exposure to noisy environments.</li> <li>Severe blow in the head.</li> <li>Loud noises.</li> <li>Not treating ear infections properly.</li> </ul> |

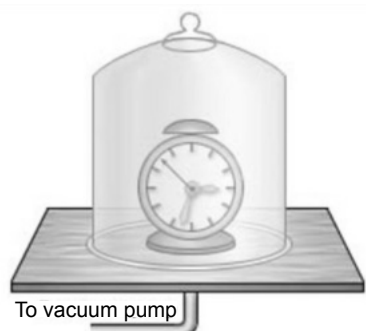
**V. Consider the statements labelled as Assertion and Reason and choose the correct option.**

- a) Both assertion and reason are true and reason is the correct explanation of the assertion.
- a) Both assertion and reason are true and reason is the correct explanation of the assertion.

**VI. Answer in detail.**

**1. Experiment to show that sound cannot travel through a vacuum:**

- Take a bell jar and an alarm clock.



Sound requires a Medium for Propagation

- Switch on the alarm clock and place it in the jar.
- Now, pump out the air from the bell jar using a vacuum pump.
- As more and more air is removed from the jar, the sound from the alarm clock becomes feebler and finally, very faint.
- It is clear from this experiment that sound cannot travel in vacuum and it needs a medium like air.

**2. Properties of sound:**

**Loudness:** It distinguishes between weak and feeble sound. It mainly depends upon the amplitude of sound. Higher the amplitude louder will be the sound and lower the amplitude lower will be the sound. Unit of loudness is decibels (dB).

**E.g.:** When a drum is softly beaten, a weak sound is produced. However, when it is beaten strongly, a loud sound is produced.

**Pitch:** It distinguishes between flatter and shriller sound. It mainly depends upon the frequency of sound. Higher the frequency of sound, higher will be the pitch. High pitch adds shrillness to a sound. Unit of pitch is hertz (Hz).

**Examples of high pitch:** The sound produced by a whistle, a bell, a flute and a violin are high pitch sounds.

**Examples of low pitch:** Roaring of a lion and the beating of a drum.

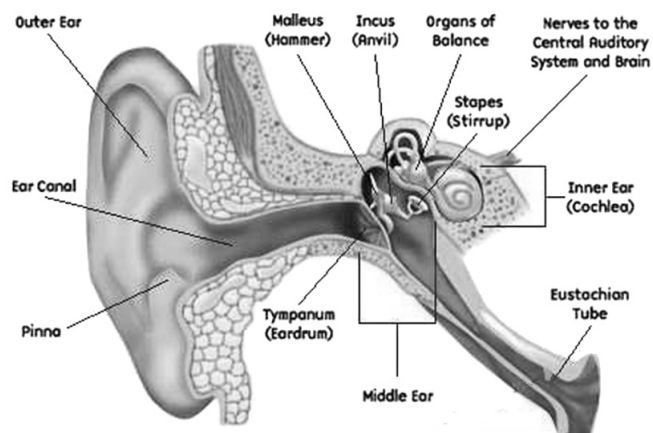
**Quality or Timbre:** Timbre is the perceived sound quality of an instrument. It is what makes a particular sound different from another sound.

**E.g.:** Take two different kinds of instruments, like a violin and a piano, and play the same note on both at the same time. Though the pitch and loudness are the same, you will be able to easily differentiate the sound quality of a violin with that of the piano.

**3. Steps needed to be taken to reduce the effects of noise pollution:**

- By setting and following strict guidelines for the usage of loudspeakers for political, religious and social purposes.

- ii. By fitting effective silencers in all automobiles.
  - iii. By consciously avoiding honking loudly or repeatedly.
  - iv. By completely refraining heavy vehicles from residential areas.
  - v. By maintaining industrial machines and household appliances properly.
  - vi. By consciously using low volumes in communication systems.
  - vii. By using earplugs when exposed to noisy environments like industries and busy roads.
  - viii. By establishing green belts in and around urban and industrial areas as per Environmental Policies and Acts of India.
  - ix. By covering thin windows with long curtains or covering floors with carpets or mats.
  - x. By planting a variety of both hedges or shrubs and taller trees to create a wall of foliage from the ground up. The rough bark and thick, fleshy leaves absorb sound due to their dynamic surface area and reduce sound pollution.
4. The ear is an important organ that enables us to hear the sounds around us. The human ear picks up the audible frequency vibrations in the air and perceives them as sounds. Though the ear is what picks up the vibrations, the brain is the prime organ that interprets the vibrations into the various sounds we hear.



### **Functioning of the human ear:**

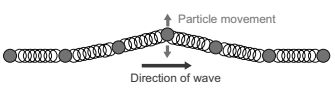
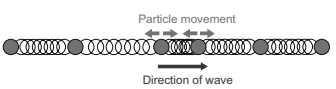
| Divisions of Ear  | Parts and Functioning of Ear                                                                                                                                |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Outer Ear</b>  | <b>Pinna:</b> It is curved in shape. Collects and directs sound wave to ear canal.                                                                          |
|                   | <b>Ear Canal:</b> It is also called auditory canal. Directs the sound waves to ear drum.                                                                    |
| <b>Middle Ear</b> | <b>Ear Drum:</b> It is also called tympanic membrane. Vibrates when the sound wave hits it.                                                                 |
|                   | <b>Ossicles:</b> These are very small bones. They amplify vibrations.                                                                                       |
|                   | <b>Oval Window:</b> Transfers vibrations to cochlea.                                                                                                        |
|                   | <b>Eustachian Tube:</b> Equalizes air pressure                                                                                                              |
| <b>Inner Ear</b>  | <b>Cochlea:</b> These are special type of cells that have fluid within them. These cells convert vibrations into nerve impulses.                            |
|                   | <b>Auditory Nerve:</b> It carries nerve impulses to brain, only when the nerve impulses reach the cerebral cortex, the listener is aware of sound produced. |
|                   | <b>Semicircular Canal:</b> It helps in balancing of body.                                                                                                   |

### **5. Differences between pitch and loudness:**

| PITCH                                                | LOUDNESS                                        |
|------------------------------------------------------|-------------------------------------------------|
| It distinguishes between flatter and shriller sound. | It distinguishes between loud and feeble sound. |
| It mainly depends upon the frequency of sound.       | It mainly depends upon the amplitude of sound.  |

|                                                                                                                                                                                                                    |                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| Higher the frequency of sound, higher will be the pitch. High pitch adds shrillness to a sound. As the voice of a female has a higher pitch than that of a male; a female's voice is shriller than a male's voice. | Higher the amplitude of the sound louder will be the sound and vice-versa.                                                       |
| Unit of pitch is hertz (Hz).                                                                                                                                                                                       | Unit of loudness is decibels (dB).                                                                                               |
| Examples of high pitch: The sound produced by a whistle, a bell, a flute and a violin.<br>Examples of low pitch: Roaring of a lion and the beating of a drum.                                                      | Examples: When a drum is softly beaten, a weak sound is produced. However, when it is beaten strongly, a loud sound is produced. |

#### 6. Differences between transverse waves and longitudinal waves:

| TRANSVERSE WAVES                                                                                                           | LONGITUDINAL WAVES                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|
| The particles of the medium vibrate in a direction that is perpendicular to the direction of propagation of the wave.      | The particles of the medium vibrate in a direction that is parallel to the direction of propagation of the wave.           |
| These waves are produced only in solids and liquid surface.                                                                | These waves are produced in solids, liquids and also in gases.                                                             |
| They propagate as crests and troughs.                                                                                      | They propagate as compressions and rarefactions.                                                                           |
| E.g. Waves in strings, light waves.<br> | E.g. Waves in springs, sound waves.<br> |

#### 7. Differences between infrasonics and ultrasonics:

| INFRASONICS                                                                                                                                    | ULTRASONICS                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A sound with a frequency below 20 Hz is called subsonic or infrasonic sound.                                                                   | A sound with a frequency greater than 20000 Hz is called ultrasonic sound.                                                                                                                 |
| Animals like elephants, rhinoceros and some fishes can hear to such low frequencies of sound.                                                  | Animals such as bats, dogs, dolphins are able to hear such high frequencies of sound.                                                                                                      |
| It is used in the study of the mechanism of the human heart called seismocardiography (recording of vibrations produced by the beating heart). | It is extensively used in medical applications like ultrasonography (visual images of organs, tissues, or blood flow inside the body) and echocardiogram (to take pictures of your heart). |
| It is employed in the earth monitoring system.                                                                                                 | It is used in the SONAR system to detect the depth of the sea and to detect enemy submarines.                                                                                              |
| Seismic sounds exist in the infrasonic range. So people monitor earthquakes by monitoring infrasonic sounds.                                   | Galton's whistle exists in the ultrasonic range. It can be heard by dogs and is used to train dogs for investigation.                                                                      |

#### VII. Solve the numerical:

- Given: Velocity of the sound in the air (V) = 330m/s, time (t) = 2 s  
Using the formula, speed=distance/time  $\Rightarrow$   
 $330 = \text{distance}/2 \Rightarrow 660 \text{ m.}$
- Given: Displacement = 2000 m, time = 8 s  
Time = 8 s  
Using the formula, velocity=displacement/time  
 $= 2000/8 = 250 \text{ m/s}$

3. Given: Velocity of wave ( $v$ ) = 25 m/s,  
Wavelength ( $\lambda$ ) = 12.5 m  
Using the formula,  $v = n \lambda \Rightarrow 25 = n (12.5)$   
 $\Rightarrow n = 2 \text{ Hz}$
4. Given: Speed of the wave ( $v$ ) = 200 m/s,  
Frequency ( $n$ ) = 500 Hz  
Using the formula,  $v = n \lambda \Rightarrow 200 = 500 (\lambda)$   
 $\Rightarrow \lambda = 0.4 \text{ m}$

## Chapter - 7 FUN WITH MAGNETS

### I. Choose the best answer:

1. d – iron and steel
2. a – attract each other
3. d – neodymium
4. d – bar magnet
5. a – Magnetic Resonance Imaging
6. d – all of these

### II. Fill in the blanks:

1. maximum
2. two
3. dynamos
4. Electromagnets
5. geographic north-south

### III. Match the following:

1. b – Natural magnet
2. c – Compass box
3. d – Ferromagnetic material
4. a – Magnetic lines
5. e – Diamagnetic material

### IV. Answer briefly:

1. Magnetic field is a region around a magnet or a magnetic material within which the force of magnetism acts. CGS unit is gauss and SI unit is tesla.
2. The property of a magnet which allows it to attract certain metals or alloys is called magnetism.

### 3. Differences between natural and artificial magnets:

| Natural Magnets                                                                                                             | Artificial Magnets                                                                                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Found in nature i.e. in the sandy deposits of the earth at different places.                                                | Man-made i.e. by people in laboratories or factories.                                                                                                                                |
| Have many impurities. They have irregular shapes and sizes and have less usage.                                             | Have fewer impurities. They are made in various shapes and sizes and have a vast usage in day to day life.                                                                           |
| They have long lasting magnetic power and are permanent magnets. Their strength is well determined and difficult to change. | Can be made with required and specific strength and their properties are time bound. Stronger than the natural magnets.                                                              |
| Examples: magnetite (iron oxide), pyrrhotite (iron sulphide), ferrite, columbite.                                           | Examples: based on shapes - bar magnets, U-shaped magnets, horseshoe magnets, cylindrical magnets, disc magnets, ring magnets and based on nature of magnetisation - electromagnets. |

### 4. Reasons behind earth acting as a huge bar magnet:

- i. A freely suspended magnetic needle at a point on the Earth comes to rest approximately along the geographical north - south direction.
- ii. This shows that the Earth behaves like a huge magnetic dipole with its magnetic poles located near its geographical poles.
- iii. Usually, when a compass needle points north it means that it is pointed towards the geographic north ( $G_N$ ). Thus, the magnetic north pole of the needle is attracted to the magnetic south pole of the earth ( $M_S$ ) as unlike poles attract each other. Thus,  $G_N$  and  $M_S$  are the same points.

- iv. Similarly, when the compass needle points south, it is pointed towards the geographic south ( $G_s$ ). This means that the magnetic south pole of the needle is attracted to the magnetic north pole of the earth ( $M_N$ ). Thus,  $G_s$  and  $M_N$  are the same points.
  - v. However, some theories suggest that concentration of magnetic substances (like iron, nickel) in earth's core, radiations from the sun, action of the moon towards the earth could be the cause of the Earth's magnetism.
5. Those materials which are not attracted by a magnet are called non - magnetic materials. Examples of non-magnetic materials are rubber, wood, leather.
  6. Materials that are attracted to a magnet are called magnetic materials. Example: iron, cobalt and nickel.
  7. (a) **Attractive property of a magnet:** Magnet attracts other magnetic materials towards it. This attraction of a magnet is more at its two poles namely – North Pole and South Pole.
  - (b) **Directive property of a magnet:** A freely suspended bar magnet always aligns itself in the geographical north – south direction. This property of a magnet is called directive property of a magnet.

**V. Consider the statements labelled as Assertion and Reason and choose the correct option:**

1. (c) Assertion is true, but reason is false.  
Correct Explanation: The attractive property of a magnet is more at poles.
2. (d) Assertion is false, but reason is true.  
Correct Explanation: The earth's magnetic field is due to the molten charged metallic fluid at its inner core.

**VI. Answer in detail.**

**1. Uses of magnets:**

- a. Magnets are used to generate electricity in dynamos.
- b. Electromagnets are used in electric bells and electric motors.

- c. They are used in loudspeakers and microphones.
- d. An extremely powerful electromagnet is used in the fast moving Maglev train to remain floating above the tracks.
- e. In industries, magnetic conveyor belts are used to sort out magnetic substances from scraps mixed with non-magnetic substances.
- f. Magnets are used in computer in its storing devices such as hard disks.
- g. In banks, the magnets enable the computers to read the MICR numbers printed on a cheque.
- h. The tip of the screw drivers are made slightly magnetic so that the screws remain attached to the tip.
- i. At hospitals, extremely strong electro magnets are used in the MRI (Magnetic Resonance Imaging) to scan the specified internal organ.

**2. Earth's Magnetism:**

- i. The bar magnet points in the north-south direction, is because of the influence of earth's gigantic magnetic field. Our planet's magnetic field is believed to be generated deep down in the earth's core.
- ii. Right at the heart of the earth is a solid inner core, two thirds of the size of the moon and composed primarily of iron. At  $5700^{\circ}\text{C}$ , this iron is as hot as the sun's surface, but the crushing pressure caused by gravity prevents it from becoming liquid.
- iii. Surrounding this is the outer core, 2250 km thick layer of iron, nickel, and small quantities of other metals. Lower pressure than the inner core means the metal here is fluid. The core of the earth is also an electromagnet. The magnetic field of the earth is caused by the charges that flow in the molten core. These charges flow at thousands of miles per hour as the earth rotates.
- iv. Some theories suggest that concentration of magnetic substances (like iron, nickel) in earth's core, radiations from the sun, action of the moon towards the earth could be the cause of the Earth's magnetism.

### 3. Differences between the characteristics of dia, para and ferro magnetic materials:

| <b>Diamagnetic Materials</b>                                                                                                           | <b>Paramagnetic Materials</b>                                                                                                     | <b>Ferromagnetic Materials</b>                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| When suspended in an external uniform magnetic field, they will align themselves perpendicular to the direction of the magnetic field. | When suspended in an external uniform magnetic field, they will align themselves parallel to the direction of the magnetic field. | When suspended in an external uniform magnetic field, they will align themselves parallel to the direction of the magnetic field.                                                    |
| They have a tendency to move away from the stronger part to the weaker part when suspended in a non-uniform magnetic field.            | They have a tendency to move from the weaker part to the stronger part when suspended in a non-uniform magnetic field.            | They have a tendency to move quickly from the weaker part to the stronger part when suspended in a non-uniform magnetic field.                                                       |
| They get magnetised in a direction opposite the magnetic field.                                                                        | They get magnetised in the direction of the field.                                                                                | They get strongly magnetised in the direction of the field.                                                                                                                          |
| Magnetic character of these substances is not affected by the external temperature.                                                    | Magnetic character of these substances is affected by the external temperature.                                                   | Magnetic character of these substances is affected by the external temperature. When they are heated, they become paramagnetic and this temperature is called the Curie temperature. |

|                                                                                                           |                                                                                                                                   |                                                                                         |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| Examples for diamagnetic substances are bismuth, copper, mercury, gold, water, alcohol, air and hydrogen. | Examples for paramagnetic substances are aluminium, platinum, chromium, oxygen, manganese, solutions of salts of nickel and iron. | Examples for ferromagnetic substances are iron, cobalt, nickel, steel and their alloys. |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|

### 4. Demagnetisation of a magnet:

A magnet loses its strength or gets demagnetised

- if left isolated for a longer time.
- when it is dropped from a height, heated to a high temperature or hammered continuously.
- passing a variable current in a coil that encloses the magnet.

#### **To prevent demagnetisation**

- magnets should be handled with care when in use.
- should be stored with magnetic keepers (iron bars) placed across the poles after the use.

### **VII. Higher Order Thinking Skills (HOTS):**

- The magnetic character of ferromagnetic materials is affected by the external temperature. When they are heated they become para magnetic. The temperature, at which the ferromagnetic material becomes paramagnetic, is called the Curie temperature. Increased thermal motion at higher temperature can disrupt and randomize the orientation and the size of the domains.
- When we slide the magnet along the iron bar it is an artificial situation of magnetization. But when we slide back and forth then each of the magnetizing strokes is demagnetized back.
- Here, Thamizh Dharaga and Sangamithirai have broken a single magnet into four pieces and hence each piece acts as a magnet having north and south poles which exists in pairs. Hence there will four north poles and four south poles – total of eight poles.

## Chapter - 8 UNIVERSE AND SPACE

### I. Choose the best answer.

1. d – all of the above
2. b – Mars
3. a – 22<sup>nd</sup> October 2008
4. d – Mars
5. c – Newton's third law
6. c – very low temperature
7. b – Apollo 8
8. a – 13.7 billion

### II. Fill in the blanks.

1. astronomy
2. Milky Way
3. 687
4. Mars Orbiter Mission
5. Neil Armstrong

### III. Say True or False. If false, correct the statement:

1. True
2. True
3. False – Mars is the second smallest planet in the solar system and Mercury is the smallest planet.
4. True
5. False – The propellants may be in the form of asolid or liquid.

### IV. Match the following.

1. b – Moon
2. e – Mars
3. a – Fuel
4. c - First manned mission to the moon
5. d - First man landing mission to the moon

### V. Answer briefly.

1. The stars, the planets, the Moon and many other objects like asteroids and comets in the sky are called celestial objects.
2. A collection of billions of stars, held together by mutual attraction, is called galaxy.
3. **Objectives of Chandryaan-1:**
  - a. Simultaneous topographical, chemical and mineral mapping on the surface of the Moon at a high spatial resolution.

- b. 3-dimensional mapping of the lunar surface.
- c. High resolution imaging of the permanently shadowed north and south poles of the moon.
- d. Search for the presence of water or ice on the surface or especially at the South Pole of the moon.
- e. Study the origin and evolution of our solar system.

### 4. **Objectives of Mangalyaan:**

- a. The primary objective of the mission was to develop the technologies to design, plan, manage and operate an interplanetary mission.
- b. To explore the constituents of Martian atmosphere.
- c. To study the surface features of Mars.
- d. To study the upper atmosphere and the dynamics of Mars.
- e. To understand the life possibilities on Mars.

5. **Cryogenic fuels:** Cryogenic fuels are fuels that require storage at extremely low temperatures in order to maintain them in a liquid state. These fuels are used in machinery that operates in space (e.g. rocket ships and satellites) because ordinary fuel cannot be used there, due to absence of an environment that supports combustion and space is a vacuum. Example: liquid hydrogen, liquid methane.

### 6. **Indians at NASA:**

- i. **Kalpna Chawla** from Punjab state of India joined the NASA in 1988 and selected to take part in the Colombia Shuttle Mission in 1997 and became the first Indian woman astronaut to go to space.
  - ii. **Sunitha Williams** another Indian started her career as an astronaut in 1998 made two trips to the International Space Station. She is one of the crew members of NASA's manned Mars mission.
7. Group of stars forming a recognizable pattern is called a constellation. Example: Orion, Leo, Cassiopeia etc.
  8. MOM refers to Mars Orbiter Mission which is India's first interplanetary mission. India is the fourth country to carry out this mission.

### **Achievements:**

- i. India is the only country that has succeeded in an interplanetary mission on its maiden attempt.
- ii. Mangalyaan completed all its primary objectives i.e. to develop the technologies to design, plan, manage and operate this mission.
- iii. This mission was planned for only six months. But, it is still working perfectly over three years now, sending incredible photos and scientific data.

### **9. Milky Way galaxy:**

- i. Our Sun and all the planets in the solar system are in the Milky Way galaxy which appears as a milk band of light in the sky.
- ii. It is made up of approximately 100 billion stars and its diameter is 100000 light years.
- iii. It is spiral in shape which has a linear, starry bar at its centre.
- iv. Sagittarius A\*, a supermassive black hole is a bright and very compact astronomical radio source at the centre of our Milky Way galaxy, near the border of the constellations Sagittarius and Scorpius.

### **VI. Answer in detail.**

#### **1. Achievements of Chandrayaan-1:**

- a. It discovered the presence of water molecules on the surface of the moon.
- b. It discovered that the moon was completely molten at some point of time.
- c. It recorded six moon mission landing sites including Apollo 15 and Apollo 17.
- d. The mineral content of the surface moon has been mapped including iron and various compositions of the rocks.
- e. It discovered lunar caves that could act as human shelters.
- f. It completed 3000 orbits around the moon and sent around 70000 images of the lunar surface.
- g. It sent images of peaks and craters of the lunar surface, which surprised the scientists as they saw that it has mostly craters.

- h. The presence of silicon, aluminium and magnesium were detected using an X-ray camera on board.

2. A rocket has a powerful system which helps in carrying not only the satellites but also people from the earth to the space. It is made up of four main parts namely - structural system, payload system, guidance system and propulsion system.

- i. **Structural system:** This gives the structure to the rocket and is basically the frame that covers the rocket. This system should be able to withstand the extreme conditions of the space. So, it is made up of strong but light weight metals like aluminium or titanium. At the base of the rocket are the fins that provide stability to the rocket during its flight.

- ii. **Payload system:** It is cargo that is to be carried to space. This may vary based on the type of the mission of the rocket. It can either be astronauts who carry out various missions in the space and space stations or it can be satellites that might be used for communication, weather monitoring, security and planetary explorations. The pointed nose carries the payload of the rocket.

- iii. **Guidance system:** This is like the brain of a rocket. It is this unit that guides the rocket to its destination. This may have radars, on board computers, sensors, communication equipment etc.

- iv. **Propulsion system:** It takes up most of the space in a rocket. It includes all the parts that make up the rocket's engine. The main purpose of this system is to provide thrust to the rocket. There are two main types of propulsion/ systems. They are liquid propulsion system and solid propulsion system. Depending on the propulsion system or the engine, a rocket is also called a liquid rocket or a solid rocket.

3. **Apollo Missions of NASA:** Apollo Missions are the most popular missions of NASA. It consists of totally 17 missions of which Apollo-8 and Apollo-11 are remarkable.

- **Apollo-8** was the first **manned** mission to go to the Moon. It orbited around the Moon and came back to the Earth.
- **Apollo-11** was the first 'Man Landing Mission' to the moon. It landed on the Moon on 20th July 1969. Neil Armstrong was the first man to walk on the surface of the Moon. The members present in the crew during the Man Landing Mission were Neil Armstrong, Buzz Aldrin and Michael Collins.

#### 4. **Big Bang expansion of the universe:**

- Scientists consider that the universe began with the start of a massive explosion called the Big Bang.
- According to the Big Bang theory, all the matter in the universe was concentrated in a single point of hot dense matter.
- About **13.7 billion years ago**, an explosion occurred and all matter was ejected in all directions in the form of galaxies.
- Nearly all of the matter in the universe is made of **hydrogen and helium**, created in the Big Bang. The core of the stars contains other gases or elements like oxygen, carbon, calcium, iron and silicon.
- The gravity that holds these stars together generally keeps these elements deep inside their interiors. When these stars explode, these fundamental building blocks of planetary systems are liberated throughout the universe.

5. **Stars:** They are the fundamental blocks of galaxies which produce heat, light, ultraviolet rays, x-rays, and other forms of radiation.

#### **Composition and formation of a star:**

- Formed when the galaxies were formed during the Big Bang.

- Largely composed of gas and plasma (a superheated state of matter).
- Built by hydrogen gases. Hydrogen atoms fuse together to form Helium atoms and in the process they produce large amount of heat.
- The brightness of a star depends on their intensity and the distance from the Earth.
- Stars also appear to be in different colours depending on their temperature. Hot stars are white or blue, whereas cooler stars are orange or red in colour.

#### 6. **Types of rocket propellants:**

| Type of Propellant | Functioning                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Liquid Propellants | <p>In liquid propellants, fuel and oxidisers are combined in a combustion chamber where they burn and come out from the base of the rocket with a great force.</p> <p><b>Fuel(s) used:</b> Liquid fuels like hydrogen, hydrazine and ethyl alcohol.</p> <p><b>Oxidizer(s) used:</b> Oxygen, ozone, hydrogen peroxide and fuming nitric acid.</p>                                      |
| Solid Propellants  | <p>In solid rocket propellants, fuel and oxidiser compounds are already combined. When they are ignited they burn and produce heat energy. Combustion of solid propellants cannot be stopped once it is ignited.</p> <p><b>Fuel(s) used:</b> Solid fuels like polyurethanes and polybutadienes.</p> <p><b>Oxidizer(s) used:</b> Nitrate and chlorate salts are used as oxidizers.</p> |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Hybrid Propellants | <p>Hybrid propellant engines represent an intermediate group between solid and liquid propellant engines. One of the substances is solid, usually the fuel, while the other, usually the oxidizer, is liquid. The liquid is injected into the solid, whose fuel reservoir also serves as the combustion chamber.</p> <p><b>Fuel(s) used:</b> Solid fuel - HTPB rubber (Hydroxyl-terminated polybutadiene).</p> <p><b>Oxidizer(s) used:</b> Liquid Oxidizer - nitrous oxide</p> |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

7. **Chandrayaan-2:** This mission used an Orbiter, Lander and Rover with the goal of exploring the South Pole of the moon. The aim of this mission was not to study just one area of the moon, but to study the exosphere, the surface and the sub-surface of it as well. It was launched on July 22, 2019 and was successfully inserted into the lunar orbit on 20 August 2019.

- a) **Orbiter:** It orbits around the moon. It is capable of communicating with Indian Deep Space Network (IDSN) as well as with the lander. The mission management has ensured that it will continue to work for seven years instead of the previously planned one year.
- b) **Lander:** It was named Vikram after Dr. Vikram A Sarabhai, the father of the Indian space programme. It was designed to work for 1 lunar day, which equals 14 earth days. In the final stage of the mission, just 2.1 km above the surface of the moon, it lost communication with the ground station on 7 September 2019. But the orbiter continues to work successfully. India had planned a soft landing but it crash-landed on the moon.
- c) **Rover:** This is a six-wheeled robotic vehicle named 'pragyan' meaning 'wisdom' in Sanskrit. It was designed to move 1 cm per second performing onsite analysis and then send the data to the Vikram lander which would have

relayed the information to the mission control room at ISRO.

8. (a) **Hubble Space Telescope:** Hubble Space Telescope (joint mission of NASA and Space Telescope Science Institute) showed us the new horizons of the universe. It is in the low Earth orbit from 1990 and has sent a wealth of information about the vast cosmos we are in.
- (b) **The International Space Station:** It is the joint mission of NASA with four other space organisations namely Roscosmos (Russia), CSA (Canada), JAXA (Japan) and ESA (Europe). It is in the low Earth orbit which allows the astronauts to conduct various experiments and study the earth.

## VII. Higher Order Thinking Skills (HOTS):

1. The near side of the Moon is the lunar hemisphere that is permanently turned towards Earth, whereas the opposite side is the far side. Only one side of the Moon is visible from Earth because the Moon rotates on its axis at the same rate that the Moon orbits the Earth which is about 29.5 days. This situation is known as synchronous rotation or tidal locking. Due to this, it is impossible for someone on Earth to see the other side of the moon.

## Chapter - 9 MATTER

### I. Choose the best answer:

1. d. All of the above
2. b. Mercury
3. b. 
4. d. Mercury
5. b. Hg
6. d. Carbon
7. c. Zinc
8. b. Malleability
9. a. Carbon
10. a. Graphite

## II. Fill in the blanks:

1. Metalloids
2. W
3. Higher
4. Hydrogen and oxygen
5. Silicon or Germanium

## III. State True or False. If false, correct the statement:

1. False – Metals are good conductors of heat and electricity.
2. False – Gallium has very low melting point.
3. False – Compounds is a pure substance which is formed due to the chemical combination of two or more elements in a fixed ratio by mass.
4. False – Coal is a non metal.
5. False – Zinc is low ductile.

- IV. 1. Steel – Sewing needle  
Copper – for making wires  
Tungsten – making filament of the bulb  
Boron – as a fuel for ignition in rockets
2. a. 1 - A, 2 - C, 3 - B, 4 - D
3. a. A – gas, B – solid, C – liquid

## V. Answer briefly:

1. Metals can be drawn into thin wires. This property of metals is called ductility.
2. a. Carbon and oxygen (CO).  
b. Sodium, Carbon and Oxygen (NaCO<sub>3</sub>)
3. (a) O (b) Au (c) Ca (d) Cd (e) Fe
4. Sodium and Potassium.
5. Oxygen
6. Metals are sonorous
7. A chemical symbol represents the name of the element. It is represented by a letter of the alphabet written in upper case. It is often the first letter of the name of the element.

Examples: hydrogen is H, nitrogen is N, sulphur is S.

Sometimes, two letters are used to write the symbol of the element.

Example: Copper is Cu, iron is Fe.

The symbol also represents an atom of that element.

8. Boron and Silicon
9. Water, hydrochloric acid, sulphuric acid.
10. Physical properties of metalloids

Metalloids are all solid at room temperature.

- i. They form alloys with other metals
- ii. Some metalloids, such as silicon and germanium are electrical conductors under specific conditions, thus they are called semiconductors.
- iii. Silicon for example appears lustrous, but is neither malleable nor ductile (it is brittle - a characteristic of some non metals). It is a much poorer conductor of heat and electricity than the metals
- iv. The physical properties of metalloids tend to be metallic, but their chemical properties tend to be non-metallic.

## VI. Answer in detail:

1. As lemon pickle is acidic and aluminum is a metal and metals react with acids to produce hydrogen gas, it is not advisable to store lemon pickle in an aluminum utensil because it will spoil the pickle and holes corrode in the vessel.
- 2.

| Property      | Metal        | Non-Metal      |
|---------------|--------------|----------------|
| Malleability  | Good         | Poor (Brittle) |
| Ductility     | Good         | Poor (Brittle) |
| Conductivity  | Good         | Very poor      |
| Melting point | Usually high | Usually low    |

3. Metals have the capacity to withstand strain without breaking. This property is called tensile strength.
4. Aluminium and brass can be made into different shapes. Also they are good conductors of heat. So they are used to make utensils.
5. The process of changing less valuable metals into gold is called alchemy.



### III. State True or False. If false, correct the statement:

- |          |          |
|----------|----------|
| 1. False | 5. False |
| 2. True  | 6. True  |
| 3. False | 7. True  |
| 4. True  |          |

### IV. Match the following:

- |                 |                                 |
|-----------------|---------------------------------|
| 1. Rusting      | - c) Iron                       |
| 2. Electrolysis | - d) Brine                      |
| 3. Thermolysis  | - e) Decomposition of limestone |
| 4. Plants       | - a) Photosynthesis             |
| 5. Ammonia      | - b) Haber's process            |

- |                         |                     |
|-------------------------|---------------------|
| 1. Rancidity            | - e) Oxidation      |
| 2. Ozone                | - c) 3 Oxygen atoms |
| 3. Tarnishing           | - d) Silver         |
| 4. Yeast                | - b) Biocatalyst    |
| 5. Calcium Oxide, Water | - a) Exothermic     |

### V. Answer briefly:

1. Chemical changes are otherwise called as chemical reactions, because one or more substances (Reactants) undergo a reaction to form one or more new substances (Products).

#### Characteristics of a chemical reaction:

- a new substance is formed
  - change is irreversible
  - energy is absorbed or released
2. Chemical reactions can be done through;
    - a. Physical contact
    - b. Solution of reactants
    - c. Electricity
    - d. Heat
    - e. Light
    - f. Catalyst

### 3. Exothermic and Endothermic reactions:

- Exothermic reaction - a chemical reaction in which heat is released.  
Example: burning of a fuel
  - Endothermic reaction - a reaction in which heat is absorbed.  
Example: ammonium chloride dissolved in water
4. a. catalyst - is a chemical substances which are alters the speed of a chemical reaction.  
b. enzymes - are biocatalysts that speed up body reactions.
  5. When you place a iron nail in a solution of copper sulphate, the blue colour of copper sulphate slowly changes into green due to chemical reaction between iron copper sulphate solution and copper gets deposited on the iron nail.
  6. The harmful changes in physical, chemical and biological properties of the environment is termed as pollution.

#### List any 3 causes for pollution:

Pollution is the release of harmful substances into the environment. Pollution may occur in soil, water or air.

- Soil: excessive use of pesticides
  - Water: waste from factories discharged into water bodies
  - Air: release of exhaust fumes from vehicles
7. Catalyst is chemical substances which are used to alter the speed of a chemical reaction.

#### Examples of catalyst in chemical reactions:

- In the electrolysis of water, sulphuric acid is used as a catalyst.
  - In the laboratory preparation of oxygen, manganese dioxide is used as a catalyst.
  - In hydrogenation of vegetable oils, finely divided nickel is used as a catalyst.
8. The sunlight is used by plants to produce starch through the chemical reaction between carbon dioxide and water.

## VI. Higher Order Thinking Skills (HOTS):

1. Yeast is used in bakeries to make bread and cakes. It is added to the dough to produce carbon dioxide which makes the dough light and spongy. Bread and cakes are soft due to carbon dioxide gas.
2. Fossil fuels like coal and petroleum are huge reservoirs of carbon and its compounds mainly nitrogen, oxygen, sulphur and hydrogen. When these fuels burn, carbon is converted to carbon dioxide, then the amount of carbon dioxide in the atmosphere is going to increase leading to intense global warming.
3. The exhaust from cars, trucks, and buses releases nitrogen oxides and sulfur dioxide into the air. These gases dissolve in rain water cause acid rain.
4. Rust is formed when an iron surface is exposed to oxygen in the presence of moisture. Several varieties of iron-oxides can be formed. Rust is non-toxic and so presents no biological hazards. The main environmental impacts of rust are the degradation of steel and iron structures, such as bridges, automobiles, etc.
5. Fresh fruit and vegetables normally have enzymes trapped in their tissues. However when the fruit is sliced, or squashed, or when the fruit or vegetable begins to break down with age, the enzymes come in contact with oxygen in the air. This causes the fruit to turn brown.

## VII. Answer in detail:

1. Food spoilage may be defined as any change that causes food to become unfit for human consumption. The chemical reactions catalyzed by the enzymes result in the degradation of food quality such as development of bad tastes and odor, deterioration and loss of nutrients.  
E.g. 1. Rotten eggs develop a bad smell due to formation of hydrogen sulphide gas  
E.g. 2. Decaying of vegetables and fruits due to microbes

### Food Spoilage can be avoided by:

- a. Keeping food in airtight containers
- b. Keeping leftover food in the refrigerator.
- c. Use preservatives such as salt, sugar etc.

2. Generally there are three types of pollutions via air, water and land pollution. Due to increasing human activities lot of chemical substances are produced artificially which harm all the living and non living things.

We can tabulate the types of chemical substances and their effects.

| # | Type of pollution | Chemical substances responsible for the pollution                                                         | Effects                                              |
|---|-------------------|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------|
| 1 | Air pollution     | Carbon dioxide, Carbon monoxide, oxides of sulphur, oxides of nitrogen, Chlorofluorocarbons, methane etc. | Acid rain, Global warming, respiratory problems etc. |
| 2 | Water pollution   | Waste water containing chemical substances (e.g dyeing industries), detergents, oil spillage etc.         | Decrease in quality of water, skin diseases etc      |
| 3 | Land pollution    | Fertilizers like urea, various pesticides, herbicides etc.                                                | Spoilage of land, cancer, respiratory diseases etc.  |

3. Chemical reactions are characterised by absorption or release of energy.

During some chemical changes, heat energy is released. These reactions are called exothermic reactions. Some exothermic reactions are:

- Combustion of LPG burns gives out heat which is used for cooking.

During some reactions, heat energy gets absorbed. These reactions are known as endothermic reactions.

- Green plants consume energy for making their food by photosynthesis.

Some reactions involve energy in the form of heat, light or sound.

For example,

When a candle burns, heat and light are given out.

Some reactions involve the production of heat, light and sound.

For example, when crackers are ignited, heat, light and sound are produced.

4. Three important conditions for a chemical reaction are:

**a. Physical conditions of reactants**

- Reactants in a powdered state react faster than big lumps of reactants.
- Some reactions undergo chemical change in solid state.

Example: a piece of coal when heated in air, combines with oxygen to form carbon dioxide

- Some reactants undergo chemical change in liquid state.

Example: colourless solutions of sodium chloride and silver nitrate react to form a white solid precipitate of silver chloride.

- Chemical reactions also take place with one of the reactant is in solid state while the other maybe in liquid or gaseous state.

Example: Tarnishing of copper or silver in air is an example of such a reaction.

**b. Role of Energy**

Energy in the form of heat, light or electricity is absorbed or released.

Different reactions require the presence of different forms of energy.

- Reactions take place on heating.

Example: When limestone is heated we get quick lime.

- Reactions occur under the influence of light.

Example: When white coloured silver chloride is exposed to day light, it turns grey.

- Reactions that take place using electrical energy.

Example: When current is passed through acidified water, it splits into hydrogen and oxygen

**c. Role of catalyst**

Some reactions take place only in the presence of a catalyst.

Catalysts are substances used to speed up a chemical reaction.

Example: Finely divided Nickel metal is used as a catalyst to convert vegetable oils to Vanaspati.

5. Fermentation is a process of decomposition of carbohydrates such as starch or sugar into an alcohol or an acid by the action of enzymes using yeast or bacteria.

- The process is involved in making alcoholic beverages like wine, beer and other spirits.
- It is the process by which milk changes to curd.

Dough gets fermented to make *dosas*.

**VIII. Value Based Questions:**

1. a. Yes.  
b. Rust is formed when an iron surface is exposed to oxygen in the presence of moisture. Several varieties of iron-oxides can form. Rust is non-toxic and so presents no biological hazards. The main environmental impacts of rust are the degradation of steel and iron structures.  
c. Corrosion levels less than 3% present a minor tensile-strength reduction of approximately 3%, whereas the tensile strength may decrease to 75–90% when the corrosion level increases more than 10%. He helped to increase the life of Kumar house and actually he saved Kumar money.
2. a. Yes, son is right.  
b. Our environment must provide us clean air to breathe, water to drink and land to produce food. Due to human activities like industries, the environment is badly affected. Due to the industries the air will be polluted and so affect the health of the people.  
The boy can suggest other places which do not have factories or industries. Places where air, water are clean.  
c. He has helped save his family from living in a polluted area and this will prevent serious health disorders.

**Chapter - 11 AIR**

**I. Choose the best answer:**

1. d. Supports burning
2. c. Carbon dioxide

3. d. sodium carbonate
4. a. blue litmus to red
5. b. Nitrogen
6. b. Nitrogen
7. b. Nitrogen

## II. Fill in the blanks:

1. Metal oxide, basic      4. Refrigerant
2. Lighter                      5. Rusting
3. Nitrogen

## III. Match the following:

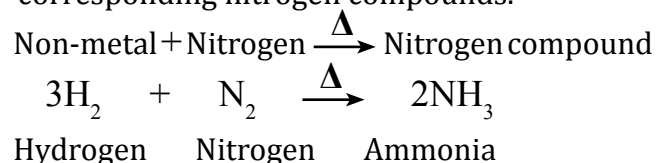
1. Nitrogen                      - Fertilizer
2. Oxygen                      - Respiration in living animals
3. Carbon dioxide - Fire extinguisher
4. Dry ice                      - Refrigerant
5. Water vapour               - Humidity

## IV. Answer briefly:

1. Most of the oxygen is a colorless, odourless gas produced by the process photosynthesis in which the chlorophyll present in the leaves of plants uses solar energy to produce glucose and releasing oxygen.
2. Some of the physical properties of oxygen are:
  - a. It is a colourless, odourless and tasteless gas
  - b. It is a bad conductor of heat and electricity
  - c. It dissolves freely in cold water
  - d. It can be liquefied at very low temperature and high pressure.
  - e. It is denser than air.
  - f. It supports combustion.
3. **Physical properties of carbon dioxide:**
  - a. It is a colorless, odourless gas.
  - b. It is heavier than air.
  - c. It dissolves in water.
4. **Uses of nitrogen:**
  - a. Used as a refrigerant in liquid state and for preservation of fresh food.
  - b. Used to provide an inert atmosphere for conducting certain chemical reactions and in reducing fire hazards.

- c. Used to prepare ammonia (by Haber's process), this is then converted into fertilizers and nitric acid.
- d. Used for inflating tyres of vehicles.
- e. Used in manufacturing of stainless steel.
- f. Used as a part of the gas in incandescent light bulbs and for filling the space above mercury in high temperature thermometers to reduce evaporation.
- g. Many explosives such as TNT (Trinitrotoluene), nitroglycerin, and gun powder contain nitrogen

5. Nitrogen reacts with non-metals like hydrogen, oxygen at high temperature to form their corresponding nitrogen compounds.



6. The green house gases are CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>, CFC (Chlorofluoro carbon) etc. The increase in the levels of these gases results in the gradual increase of temperature of the earth's surface. This increased green house effect is caused due to increase in the air pollutants and it results in the average increase of temperature of the atmosphere. This is called as Global warming.
7. The carbon dioxide gas in its solid form is called dry ice. It is used as a refrigerant. It is so cold that moisture in the air condenses on it, creating a dense fog which is used in stage shows and movie effects.

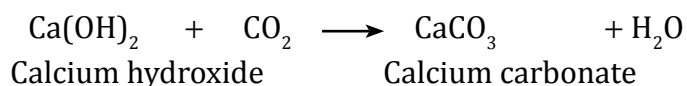
## 8. Nitrogen fixation:

Nitrogen is available in elemental state or in combined form. It is essential for the growth of plants. However, plants cannot use elemental nitrogen from air directly. This is because plants need soluble compounds of nitrogen. Thus, plants depend on certain processes for the supply of nitrates.

Any process that converts nitrogen in the air into a useful nitrogen compound is called nitrogen fixation. This process can occur naturally (in a specific group of plants) or can be done artificially converting nitrogen to ammonia, ammonium nitrate or any other compound useful for plants.

## V. Answer in detail:

1. When a limited amount of  $\text{CO}_2$  is passed through lime water turns milky due to the formation of insoluble calcium carbonate. When an excess amount of  $\text{CO}_2$  is passed through lime water, it first turns milky and the milkyness disappears due to the formation of soluble calcium hydrogen carbonate,  $\text{Ca}(\text{HCO}_3)_2$ .

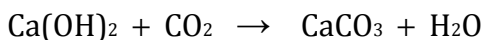


2.

- a) Carbon dioxide,  $\text{CO}_2$  and carbon monoxide, CO
- b) Sulphur dioxide,  $\text{SO}_2$
- c) Phosphorus reacts with oxygen, usually forming two oxides depending on the amount available oxygen:  $\text{P}_2\text{O}_3$  when reacted with a limited supply of oxygen, and  $\text{P}_2\text{O}_5$  when reacted with excess oxygen
- d) Magnesium oxide, MgO
- e) Ferric oxide,  $\text{Fe}_3\text{O}_4$
- f) Sodium oxide,  $\text{Na}_2\text{O}$

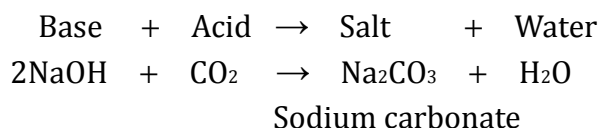
3. a)  $4\text{K} + 3\text{CO}_2 \rightarrow 2\text{K}_2\text{CO}_3 + \text{C}$   
Potassium                      Potassium carbonate

- b) When a limited amount of  $\text{CO}_2$  is passed through lime water, it turns milky due to the formation of insoluble calcium carbonate.



Calcium carbonate When an excess amount of  $\text{CO}_2$  is passed through lime water, it first turns milky and the milkyness disappears due to the formation of soluble calcium hydrogen carbonate,  $\text{Ca}(\text{HCO}_3)_2$ .

- c) Sodium hydroxide (base) is neutralized by carbon dioxide (acidic) to form sodium carbonate (salt) and water.



4. Acid rain affects us in many ways. Some of the consequences are given below.
- a) It irritates eyes and skin of human beings.

- b) It inhibits germination and growth of seedlings.
- c) It changes the fertility of the soil, destroys plants and aquatic life.
- d) It causes corrosion of many buildings, bridges, etc.

Acid rain and its effects can be controlled by the following ways.

- a) Minimizing the usage of fossil fuel such as petrol, diesel etc.,
  - b) Using CNG (Compressed Natural Gas).
  - c) Using non-conventional source of energy.
  - d) Proper disposal of the industrial wastes.
5. The cycle of photosynthesis and respiration maintains the balance of carbon dioxide and oxygen on earth. Photosynthesis in plants requires carbon dioxide which is converted to makes glucose and oxygen is released. It is the released oxygen that is used by us and most other organisms for cellular respiration. We breathe in that oxygen, which is carried through our blood to all our cells. In our cells, oxygen allows cellular respiration to proceed.

The glucose is then turned back into carbon dioxide, which is used in photosynthesis. While water is broken down to form oxygen during photosynthesis, in cellular respiration oxygen is combined with hydrogen to form water. While photosynthesis requires carbon dioxide and releases oxygen, cellular respiration requires oxygen and releases carbon dioxide.

## VI. Higher Order Thinking Skills (HOTS):

- 1. The coefficient of expansion of gases is large. Therefore, the gas in the bottle expands. Hence, the pressure inside the bottle increases. Thus, the bottle may burst in hot summer.
- 2. Animals undergo a process called respiration which is essential for us to live. Similarly plants go through two processes - Respiration and Photosynthesis. These two processes are completely different from each other. In photosynthesis the plants take in carbon dioxide and release oxygen while in respiration there is intake of oxygen and release of carbon dioxide. These two processes are always done

by the plants. During the day there is enough sunlight and the plants carry photosynthesis on a large scale but during the night respiration takes place. So at night these plants release carbon dioxide and there is lack of oxygen. That is why it is not advised to sleep under a tree during night.

3. Fishes respire with the help of their gills. Gills are richly supplied with blood capillaries and can readily absorb the oxygen dissolved in water. The water contains some dissolved oxygen in it. When the water enters the fish through its mouth, the dissolved oxygen is taken inside and carbon dioxide is given out through the gills. In this way, the fish breathe in water. When fish are taken out of water, the supply of oxygen to the fish is cut as the fishes cannot absorb and breathe the oxygen present in the atmosphere. Hence, they die after some time.
4. Water, which is made of oxygen and hydrogen atoms bonded together, is also used to maintain oxygen supply on the International Space Station. Using a process called electrolysis, which involves running electricity through water, astronauts and cosmonauts are able to split the oxygen from the hydrogen.
5. The atmosphere contains oxygen as a component of air. It is with the help of this oxygen that meteoroids burn up in the atmosphere.

However, beyond the earth's atmosphere, there is no air. Due to absence of oxygen, meteoroids cannot burn and continue to revolve in space.

## VII. Analyse the following:

Sewing needles, knives etc. are made of steel. Iron is one of the metals used to make steel. Iron undergoes rusting when exposed to air.

These items can be coated with a thin layer of oil or wax and wrapped in tissue paper or a towel to prevent exposure to moist air.

## Chapter - 12 ATOMIC STRUCTURE

### I. Choose the best answer:

1. b. definite proportion

2. c. negatively charged particles
3. a. 1:8
4. c. elements are made up of atoms
5. c. the atomic number is same and the mass number is different

### II. Fill in the blanks:

1. Atom
2. Same
3. Protons, neutrons and electrons
4. Anion, cation
5. Electron
6. Negatively

### III. Match the following:

1. Law of conservation of mass – d. Lavoisier
2. Law of constant proportion – c. Joseph Proust
3. Cathode rays – a. Sir William Crookes
4. Anode rays – e. Goldstein
5. Neutrons – b. James Chadwick

### IV. Answer briefly:

1. The law of conservation of mass states that during any chemical change, the total mass of the products is equal to the total mass of the reactants.
2. The **law of constant proportions** states that chemical compounds are made up of elements that are present in a fixed ratio by mass. This implies that any pure sample of a compound, no matter the source, will always consist of the same elements that are present in the same ratio by mass.
3. Properties of Anode rays:
  - a) Anode rays travel in straight lines from the anode to the cathode.
  - b) Anode rays are made up of material particles.
  - c) Anode rays are deflected by electric and magnetic fields. Since, they are deflected towards the negatively charged plate; they consist of positively charged particles.
  - d) The properties of anode rays depend upon the nature of the gas taken inside in the discharge tube.

- e) The mass of the particle is the same as the atomic mass of the gas taken inside the discharge tube.
4. Valency of an element can be defined as the number of hydrogen atoms which combine with one atom of that element. For example a molecule of hydrogen chloride consists of an atom of hydrogen combined with a chloride ion. Hence valency of chlorine is 1. In hydrogen chloride molecule, one hydrogen atom combines with one chlorine atom.
5. When an atom gains an electron it has more number of electrons and thus it carries negative charge. At the same time when an atom loses an electron it has more number of protons and thus it carries positive charge. These atoms which carry positive or negative charges are called ions.
6. A chemical equation is a short hand representation of a chemical reaction with the help of chemical symbols and formulae. Every chemical equation has two components: reactants and products. Reactants are the substances that take part in a chemical reaction and the products are the substances that are formed in a chemical reaction.
- 7.
- Carbon monoxide
  - Nitrous oxide
  - Nitrogen dioxide
  - Phosphorus pentachloride
- 8.
- cation - calcium ion  
anion - sulphate ion
  - cation - magnesium ion  
anion - chloride ion
  - cation - ferrous ion  
anion - oxide ion
9. Electrons - are negatively charged particles. Their mass is very very low.  
Protons - are positively charged particles. Their mass is nearly that of hydrogen atom.
10. a. Na (11) — 1e  
b. N (5) — 3e

## V. Answer in detail.

1.

| Sl. No. | Compound                          | Name of the cation/anion | Formula for cation/anion | Valency of cation/anion |
|---------|-----------------------------------|--------------------------|--------------------------|-------------------------|
| a.      | NaCl                              | Sodium                   | Na <sup>+</sup>          | 1                       |
| b.      | CO <sub>2</sub>                   | Carbon                   | C <sup>4+</sup>          | 4                       |
| c.      | Al(PO <sub>4</sub> )              | Aluminium                | Al <sup>3+</sup>         | 3                       |
| d.      | Ba(NO <sub>3</sub> ) <sub>2</sub> | Barium                   | Ba <sup>2+</sup>         | 2                       |
| e.      | CaCl <sub>2</sub>                 | Calcium                  | Ca <sup>2+</sup>         | 2                       |

2.

- Al<sub>2</sub>SO<sub>4</sub>
- AgNO<sub>3</sub>
- MgO
- BaCl<sub>2</sub>

3.

| Sl. No. | Skeletal equation                             | Balanced equation                              |
|---------|-----------------------------------------------|------------------------------------------------|
| a.      | C + O <sub>2</sub> → CO <sub>2</sub>          | C + O <sub>2</sub> → CO <sub>2</sub>           |
| b.      | P + Cl <sub>2</sub> → PCl <sub>5</sub>        | 2P + 5Cl <sub>2</sub> → 2PCl <sub>5</sub>      |
| c.      | S + O <sub>2</sub> → SO <sub>2</sub>          | S + O <sub>2</sub> → SO <sub>2</sub>           |
| d.      | Mg + HCl → MgCl <sub>2</sub> + H <sub>2</sub> | Mg + 2HCl → MgCl <sub>2</sub> + H <sub>2</sub> |

4.

- 4Na + O<sub>2</sub> → 2Na<sub>2</sub>O
- 3 Ca + N<sub>2</sub> → Ca<sub>3</sub>N<sub>2</sub>
- N<sub>2</sub> + 3H<sub>2</sub> → 2NH<sub>3</sub>
- CaCO<sub>3</sub> + 2HCl → CaCl<sub>2</sub> + CO<sub>2</sub> + H<sub>2</sub>O
- 2Pb(NO<sub>3</sub>)<sub>2</sub> → 2PbO + 4NO<sub>2</sub> + O<sub>2</sub>

## 5. Dalton's atomic theory proposed that

- all matter was composed of minute particles called atoms.
- Atoms are indivisible and indestructible building blocks.

- Dalton's atomic theory also stated that compounds were composed of combinations of these atoms in certain small ratios.
- Dalton also postulated that chemical reactions resulted in the rearrangement of the reacting atoms.

6. Valency may be defined as the number of electrons an element can accept or donate or share to acquire a stable configuration.

The reactivity of an atom is dependent on the number of electrons present in its outermost orbit or the valence shell. If the outermost orbit of an atom has reached its maximum capacity of electrons, then the atom will be chemically inert or stable. Such an element will not react easily with any other elements.

Inert gases have complete outermost orbits with duplet or octet state, making it difficult for these elements to react with any other elements.

7. Atoms of some elements combine with atoms of other elements and form more than one kind of compound. The elements are said to have variable valency.

The suffix-ous is attached at the end of the name of the metal such as cuprous, ferrous etc. to indicate lower valency.

In case of the higher valency the suffix ic is attached at the end of the name of the metal or use is made of the Roman numeral such as I, II, III, IV etc. to indicate valency.

For example, copper combines with oxygen and forms two products namely cuprous oxide ( $\text{Cu}_2\text{O}$ ) and cupric oxide ( $\text{CuO}$ ).

$\text{Cu}^+$  Cupros (or) Copper (I)

$\text{Cu}^{2+}$  Cupric (or) Copper (II)

$\text{Fe}^{2+}$  Ferrous (or) Iron (II)

$\text{Fe}^{3+}$  Ferric (or) Iron (III)

$\text{Hg}^+$  Mercurous (or) Mercury (I)

$\text{Hg}^{2+}$  Mercuric (or) Mercury (II)

## 8. Main features of Rutherford's Model of an atom

In the year 1911, Ernest Rutherford, a British physicist, proposed an atomic model. The main features of the model are as follows:

- An atom consists of subatomic particles namely, protons, electrons and neutrons.
- Protons and neutrons are found at the centre of an atom, called the nucleus.
- Electrons revolve around the nucleus in a circular path, called orbits or shells.
- An atom has one or more orbits and each orbit has a definite number of electrons.

## VI. Higher Order Thinking Skills (HOTS):

1. A light paddle wheel, when placed in the path of the cathode rays, began to rotate because the small particles of the cathode rays (electrons) have mass and energy. This energy is used in rotating the paddle wheel.
2. By observing the deflection of electrons in electrical and magnetic fields.
3. a) He observed all the compounds with two or more elements and noticed that each of such compounds had the same elements in same proportions, irrespective of where the compound came from or who prepared it.  
b) Law of constant proportions – It states that in a pure chemical compound the elements are always present in definite proportion by mass.

## Chapter - 13 WATER

### I. Choose the best answer:

1. a)  $0^\circ\text{C}$
2. b) pressure is high
3. b) hydrogen
4. a) lead
5. a) sulphates and chlorides

## II. Fill in the blanks:

1. tasteless
2. 100°C
3. boiling
4. 4°C
5. electrolysis

## III. State True or False. If false, correct the statement:

1. True
2. False – About 90% of the available surface water has already been tapped mainly for agriculture and irrigation. The salt in the sea water would affect the crops.
3. True
4. False – Water that is used for drinking or fit for drinking is called potable water.
5. False – Soap doesn't lather well in hard water due to the presence of chloride and sulphate salts of calcium and magnesium in the water.

## IV. Match the following:

1. d – Water
2. e – Digestive ailments
3. b – Kills germs
4. c – Ozonisation
5. a – Water pollutant

## V. Give reasons for the following:

1. Potash alum is added to water, to speed up the process of sedimentation. This process is called loading. The particles of potash alum combine with the suspended impurities and make them settle down at a faster rate.
2. Water can dissolve several more substances than any other solvent. Therefore, it is called as universal solvent.
3. Generally, liquids contract on cooling and the density increases. However, water is special. It contracts when cooled, down to a temperature of 4°C but thereafter begins to expand as it reaches 0°C and turns into ice. Water attains its maximum density at 4°C. This is called anomalous expansion of water. It is because of this property that ice floats in water.
4. Air dissolved in water contains approximately 35.6% oxygen along with nitrogen and carbon

dioxide. Fish extract the oxygen from the water which enters their body through the gills. Fish can survive in water only by utilising the oxygen dissolved in water.

5. Every litre of sea water contains about 35 grams of dissolved salts most commonly known as sodium chloride (NaCl). Sea water also contains several other dissolved salts which are harmful to humans. Such water is called saline water. It is not suitable for drinking and is said to be non-potable water. The water suitable for drinking is called potable water. Every litre of potable water contains 1-2 grams of dissolved salts, mainly common salt with small amounts of calcium (Ca), magnesium (Mg), potassium (K), copper (Cu) and zinc (Zn).
6. Hard water consists of carbonate and bicarbonate salts of calcium or magnesium/ chloride and sulphate salts of calcium and magnesium which damages the utensils and containers in which it is stored and forms a hard layer.

## VI. Define the following:

1. Freezing Point: The temperature at which a liquid changes to solid at normal atmospheric pressure is called freezing point.
2. Boiling Point: The temperature at which a liquid changes to vapours at normal atmospheric pressure is called boiling point.
3. Specific heat capacity: It is defined as the amount of heat needed to raise the temperature of 1 gram of a substance by 1 degree Celsius (°C).
4. Latent heat of fusion: The amount of heat energy required to change 1g of ice to water is called latent heat of fusion of ice.
5. Potable water: Water that is safe for humans to drink is called potable water.

## VII. Answer briefly:

1. The gas evolved at cathode is hydrogen and the gas evolved at anode is oxygen gas when water is electrolysed. The volume of hydrogen gas collected at the cathode is two times the volume of oxygen gas collected at the anode i.e. the ratio of hydrogen to oxygen is 2:1.

- Importance of dissolved oxygen in water: Oxygen dissolved in water is important for the living organisms to survive. Fish absorb oxygen dissolved in water as the water flows through the gills. Fish can survive in water only through the dissolved oxygen present in water.

Importance of dissolved carbon dioxide in water: Aquatic plants make use of dissolved carbon dioxide for photosynthesis. Carbon dioxide dissolved in water reacts with limestone to form calcium bicarbonate. Marine organisms such as snails, oysters, etc., extract calcium carbonate from calcium bicarbonate to build their shells.

- Temporary hardness is due to the presence of carbonate and bicarbonate salts of calcium and magnesium, and permanent hardness results due to the presence of chloride and sulphate salts of calcium and magnesium.
- The amount of heat energy required to change 1g of water to gas at atmospheric pressure at its boiling point is called latent heat of vaporization of water. For water, its value is  $22.60 \times 10^5$  J/Kg in SI units or 540 calories per gram in CGS units.
- Temporary hardness of water can be removed by boiling the water or treating with lime water whereas permanent hardness of water can be removed by treating with washing soda or by ion exchange method. Distillation is another process through which both temporary and permanent hardness can be removed.
- Some substances absorb a definite amount of water and remain as hydrated salts. The water present in crystals, gives them their shining appearance and geometrical shapes. This water is called water of crystallization or water of hydration.  
For example, blue copper sulphate crystals contain five water molecules per mole. So the molecular formula of copper sulphate is written as,  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ .

**Some hydrated salts are:**

Copper Sulphate  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  Blue Vitriol

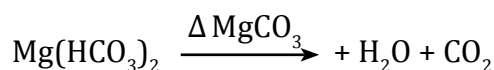
Sodium Carbonate  $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$  Washing soda

Ferrous Sulphate  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$

- Temporary hardness of water can be removed in any of the following ways:

i. By boiling:

When hard water is boiled, the bicarbonate decomposes to give the insoluble carbonate which can be removed by filtration.



ii. By adding lime (Clark process):

Hard water is treated with lime solution. The bicarbonates are converted into insoluble calcium carbonate which is then removed by filtration.

iii. By adding washing soda: (Sodium Carbonate)

Adding washing soda to hard water removes temporary hardness. The bicarbonates of calcium and magnesium are converted into their insoluble carbonates.

- Generally, liquids contract on cooling and the density increases. However, water contracts when cooled, to a temperature of  $4^\circ\text{C}$  but thereafter begins to expand as it reaches  $0^\circ\text{C}$  and turns into ice. Water attains its maximum density at  $4^\circ\text{C}$ . This property of water is called anomalous expansion of water. It is because of this property that ice floats on water.

## VIII. Answer in detail:

- The water from various sources is unfit for drinking, cooking, washing or bathing because it contains suspended and dissolved impurities. It also contains micro-organisms such as bacteria. If this water is consumed without purifying, it can cause water-borne diseases such as typhoid and cholera. Therefore, before water reaches our homes, it is treated and purified to make it potable. In conventional water treatment plants, water is subjected to different processes for purification. These processes are discussed below:

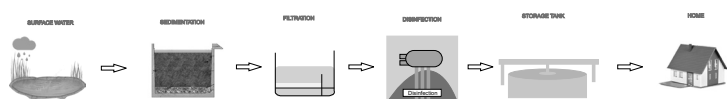
**Sedimentation:** Water from lakes or rivers is collected in large sedimentation tanks. There, it is allowed to stand undisturbed so that suspended impurities settle down at the bottom of the tank. Sometimes, a potash alum is added to water, to speed up the process of sedimentation. This process is called loading. The particles of potash alum combine with the suspended impurities and make them settle down at a faster rate.

**Filtration:** Water from the sedimentation tanks is then, pumped to the filtration tanks. Filtration tanks contain filter beds made up of gravel, sand, pebbles, activated charcoal and concrete. Water passes through these layers and becomes free from any remaining dissolved or suspended impurities.

**Sterilisation or disinfection:** The filtered water is treated chemically to remove the remaining germs or bacteria. This process is called sterilisation. The chemicals that are used in this process are chlorine and ozone. The process of adding chlorine, in adequate amounts, to water is called chlorination.

The water from filtration tanks is pumped into chlorination tanks, where chlorine is added to remove harmful bacteria and other germs. Ozonisation is a process in which water is treated with ozone gas to kill the germs present in it.

The sterilisation of water can also be done by exposing it to air and sunlight. Oxygen from the air and sunlight destroy the germs present in water. Aeration is the process in which air under pressure is blown into filtered water. This also helps to kill the germs.



**Storage tank:** The water is then passed into large storage tanks and left for a while for the action of disinfection to be complete. At the

tail end of this storage tanks, huge pipes are connected to transport water to our homes and workplaces.

2. Permanent hardness of water is due to the presence of chloride and sulphate salts of calcium and magnesium.

It can be removed by following processes:

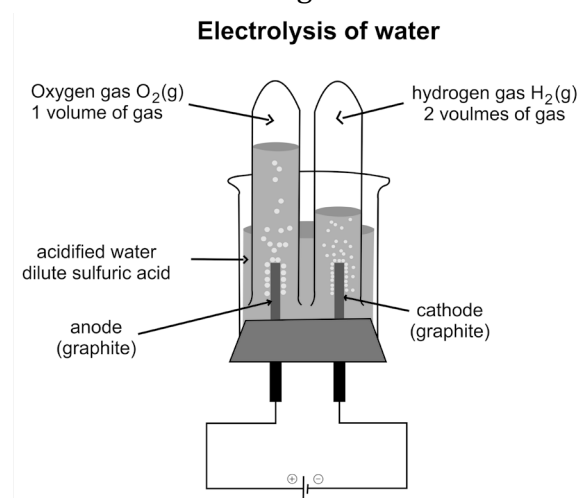
**Adding washing soda:** Washing soda is used to remove permanent hardness of water. Adding washing soda converts chlorides and sulphates into insoluble carbonates. These insoluble carbonates are removed by filtration.

**Ion-exchange method:** Another method used to remove the hardness of water is to pass it through a column of ion-exchange resins where calcium and magnesium ions get replaced by sodium ions. This converts hard water into soft water.

**Distillation:** Temporary and permanent hardness both can be removed by the method of distillation. The water obtained after distillation is called distilled water. It is the purest form of water.

3. When an electrical current is passed through water, it is broken up into hydrogen and oxygen gases. This process of decomposition of water into hydrogen and oxygen gas due to passage of electric current is called **electrolysis of water**.

The set-up of an apparatus for electrolysis of water is shown in the figure.



### Procedure:

- In this set-up, a beaker is fixed with two graphite (*carbon*) rods using a rubber stopper. These rods act as electrodes (*a conductor through which electricity enters or leaves*) are connected to a battery of 6V.
- The electrode connected to the positive terminal of the battery is the anode and the electrode connected to the negative terminal of the battery is the cathode.
- The beaker is filled with water such that the two graphite rods are immersed in it.
- Add a few drops of dilute sulphuric acid which acts as an electrolyte. The electrolyte is necessary because pure water will not carry enough charge due to the lack of ions.
- Take two test tubes filled with water and invert them over the two graphite electrodes.
- It is observed that bubbles are formed at both the electrodes. This shows that gases are collected in both the test-tubes.

### Observation:

- If a candle is brought near the anode, it burns more brightly showing that it is oxygen gas. If the candle is brought near the cathode, it burns with a popping sound showing that it is hydrogen gas.
- The volume of hydrogen gas collected at cathode is two times than the volume of oxygen gas collected at anode i.e., the ratio of hydrogen to oxygen is 2:1.

### Inference:

This concludes that water is made up of hydrogen and oxygen.

The reaction is:  $2\text{H}_2\text{O} \xrightarrow{\text{(passage of current)}} 2\text{H}_2 + \text{O}_2$

- Water pollution is the pollution of bodies of water, such as groundwater, lakes, rivers, seas, and the oceans. It occurs when pollutants of domestic, agricultural and industrial wastes

reach these bodies of water, without treatment which results in the contamination of water. Let us see some of the sources of the water pollution.

**Household Detergents:** Most of us use synthetic detergents, shampoos, shower gels, soaps at our homes for cleaning utensils, washing clothes, wiping the floors, and cleaning ourselves. They have small round pieces of plastic added to them called microbeads. Further, they cannot be broken and end up polluting both surface and ground water. Excessive use of these detergents affects fish and other animals when they enter water bodies.

**Domestic Sewage:** Domestic Sewage means waste water produced due to human activities in households; i.e. wastewater from the kitchen, shower, wash basin, toilet and laundry.

This untreated sewage contains impurities such as organic matter from food waste and toxic chemicals which may also contain disease causing microbes.

**Domestic Waste and Plastics:** Domestic waste is waste that is generated by humans in their day today life. The plastic items lying on the side of the roads eventually drain into different water bodies. They end up choking the water bodies and aid in spreading vector borne diseases such as malaria and dengue.

**Agricultural causes:** Fertilizers, pesticides and insecticides used in agricultural fields dissolve in rain water and flow into water bodies such as rivers and lakes. Excess accumulation of nutrients such as nitrates and phosphates as well as other toxic chemicals in water bodies leads to eutrophication, which is harmful for aquatic life and life in general.

**Thermal pollution:** Thermal pollution occurs when powerplants and factories discharge hot or cold water into nearby water bodies, causing rapidly changing water temperature. Most

marine organisms have specific temperature needs and are unable to survive sudden changes. Even small temperature changes result in thermal shock to aquatic life, causing reproduction difficulties and lower disease resistance.

**Industrial Waste:** Industrial water pollution is caused by the discharge of harmful chemicals and compounds into water like sulphur, asbestos, lead, mercury, cyanides and cadmium. If this is not regulated before releasing into waterbodies it impacts aquatic life and makes water unfit for consumption by living beings.

**Oil Spills:** Contamination of seawater due to oil spills either during exploration or transportation causes a serious threat to aquatic life. As oil floats on water, the surface blocks sunrays reducing the oxygen levels and suffocates marine life.

**Note:** Any four of the above reasons can be written as an answer.

5. Water pollution is the contamination of water bodies, usually as a result of human activities. Water bodies include lakes, rivers, oceans and groundwater. Water pollution results when contaminants are introduced into the natural environment.

Agricultural operations and industrial wastes contaminate water.

**a. Agricultural operation**

- Fertilizers, pesticides and insecticides used in agriculture dissolve in rain water and flow into water bodies such as rivers and lakes.
- Excess accumulation of nutrients such as nitrates and phosphates as well as other toxic chemicals in water bodies leads to eutrophication, which is harmful for aquatic life.
- Most marine organisms have specific temperature needs and are unable to survive sudden temperature changes. Even small

temperature changes result in thermal shock to aquatic life, causing reproduction difficulties and lower disease resistance capacity of marine life.

**b. Industrial Waste**

- Industries cause water pollution by the discharge of harmful chemicals and compounds sulphur, asbestos, lead, mercury, cyanides and cadmium into water bodies. These chemicals are very dangerous and water becomes toxic.

Besides, many of the chemicals maybe at high temperature and can destroy all plant and animal life in the water bodies.

6. The safest and most beneficial drinking water is distilled water. It is free of toxins, chemicals, bacteria and viruses.

Distilled water is found to be 99.9% pure. It is by far the cleanest water available for consumption. It is used to make crystal clear ice cubes, for diluting medicines, for baking and cooking, for cleaning wounds, in car batteries and radiators.

**Preparation of Distilled water**

Water to be distilled is taken in a distillation flask that is connected to a Liebig condenser. This condenser is further connected to a receiving flask.

Now, the distillation flask is heated so that the water in the flask starts boiling and gets converted to steam. The vapour passes into the Liebig condenser, where it is cooled and condenses to water and is collected in the receiving flask.

The water in the receiving flask is pure water free of contaminants and any impurities. This is one of the easiest methods of water purification.

**IX. Higher Order Thinking Skills (HOTS):**

1. Distilled water is about 99% pure water. It does not contain any dissolved impurities. Hence distilled water freezes at 0°C.

Impurities lower the freezing point of a liquid.

River water contains several dissolved salts. These impurities in the water lower the freezing temperature of river water.

Hence distilled water freezes first and river water freezes later.

- Crystals of ferrous sulphate are greenish in colour and have a definite crystalline shape. On heating, the crystals lose water of crystallisation and crumble to a white powder.
- Pure water is colourless, odourless and tasteless. However potable water contains traces of compounds that are not harmful but impart a slight taste to water. The type of salts and quantity of these in water varies from place to place. Hence water tastes different in different places.

**X. Analyse the following:**

- Generally, liquids contract on cooling and the density increases. However, water contracts when cooled till  $4^{\circ}\text{C}$  but thereafter, water begins to expand till it reaches  $0^{\circ}\text{C}$  and turns into ice. Water attains its maximum density at  $4^{\circ}\text{C}$ . This property is called anomalous expansion of water. When water cools below  $4^{\circ}\text{C}$ , it expands, becomes lighter and floats on the surface. When water on the surface freezes, it becomes ice and floats on the surface. Below the layer of ice, water is at  $4^{\circ}\text{C}$  and is in the liquid state. So fish continue to live in this water, just below the layer of ice.

## Chapter - 14 ACIDS AND BASES

**I. Fill in the blanks:**

- |                          |               |
|--------------------------|---------------|
| 1. benzoic               | 4. CaO        |
| 2. acidus                | 5. Alkaline   |
| 3. bitter                | 6. Indicators |
| 7. deep pink or deep red |               |

**II. Choose the best answer:**

- a) sour
- c) a, b, c – acids, bases, salts
- c) red
- a)  $\text{OH}^-$

- |                   |                      |
|-------------------|----------------------|
| 5. d) alkali      | 8. a) salt and water |
| 6. d) formic acid | 9. a) basic          |
| 7. a) acidity     | 10. d) red           |

**III. State True or False. If false, correct the statement:**

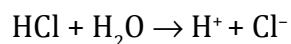
- False – Most acids are soluble in water as acids are ionic compound and ionic compound have property of solubility in water.
- False – Acids are sour in taste and bases are bitter in taste
- False – Bases give soapy touch only in aqueous media not in dry nature.
- True
- False – Alkalies are bases because they all alkalies are soluble in water. However not all bases are alkalis because not all bases dissolve in water.
- True

**IV. Answer briefly:**

- Acids are defined as those chemical substances which release hydrogen ions when dissolved in water.

Example:

Hydrochloric acid + Water  $\rightarrow$  Hydrogen ion + Chloride ion



**2. Physical Properties of Acids:**

- Acids are sour to taste and colourless.
- Most acids exist as liquids whereas some acids like benzoic acid exist in solid state.
- Strong acids are corrosive in nature. They act on metals, cloth etc. They are corrosive on the skin.
- They dissolve in water and their solutions conduct electricity.

**3. Similarities between acids and bases:**

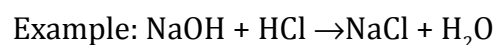
- They both are corrosive in nature.
- They both ionise in aqueous solution.
- They conduct electricity in aqueous solution.
- They undergo neutralization reaction.

#### 4. Differences between acids and bases:

| Acids                                                               | Bases                                                         |
|---------------------------------------------------------------------|---------------------------------------------------------------|
| Acids produce $H^+$ ions in aqueous solution.                       | Bases produce $OH^-$ ions in aqueous solution.                |
| Acids are sour to taste.                                            | Bases are bitter to taste.                                    |
| Most of the acids are in liquid state and a few are in solid state. | Bases are in solid state and a few bases are in liquid state. |
| Acids turn blue litmus paper to red.                                | Bases turn red litmus to blue.                                |
| Acids give a tingling sensation when touched.                       | Bases in aqueous solution give a slippery feel when touched.  |

5. An indicator is a chemical substance (either natural or artificial) which indicates the end of a chemical reaction by a suitable colour change. Example: Extracts of turmeric powder, hibiscus, beetroot and vegetables are used as natural indicators. Phenolphthalein and methyl orange are artificial indicators.

6. When acids and bases are mixed together in aqueous solution, they react chemically to produce salt and water. This is known as neutralisation reaction.



#### 7. Physical properties of bases:

- Bases are slippery to touch in an aqueous media.
- They usually taste bitter and colourless and corrosive in nature.
- They exist mostly in solid state but some exist in liquid state.  
Eg. Ammonium hydroxide
- They change the colour of red litmus paper into blue, turn methyl orange, yellow and turn phenolphthalein indicator, pink.
- They conduct electricity in aqueous medium. This is because they ionize in water to form

cations (+ ve) and anions (– ve).

#### V. Answer in detail.

##### 1. Uses of Acids:

- The acid (Hydrochloric acid) present in our stomach helps in breaking down and digestion of food.
- Diluted acetic acid (vinegar) is used in processing and preservation of food.
- Benzoic acid is also used as a preservative for food items like pickles.
- Hydrochloric acid is used in the production of PVC, a type of plastic.
- Nitric acid and sulphuric acid are used to manufacture fertilisers.
- Citric acid is used in the food industry as lemon flavouring.
- Tartaric acid is used in food industries to give tart flavour to food.
- Carbonic acid gives fizz to carbonated drinks.
- Ethanoic acid is used for cleaning purposes like cleaning metals before electroplating, processing leather, maintaining swimming pools, etc.
- Sulphuric acid is used in batteries.
- All living organisms have cells that contain fundamental elements called nucleic acid. Animals have DNA (Deoxyribonucleic acid) and plants have RNA (Ribonucleic Acid).

##### 2. Uses of Bases:

- Sodium hydroxide and potassium hydroxide are used in the manufacturing of soaps and detergents.
- Sodium hydroxide is also used in paper industries, textile industries and in the preparation of medicines.

- iii. Calcium hydroxide is used to neutralize acidity in soil and in white washing. It is also used in manufacturing bleach.
- iv. Aluminium hydroxide and magnesium hydroxide (milk of magnesia) are used as antacids.
- v. Ammonium hydroxide is used as a laboratory reagent. It is also used in the manufacturing of rayon, rubber, plastic, dye, etc.

### 3. Neutralisation reactions in our daily life:

#### Ant bite or bee sting:

- i. When an ant bites or a bee stings, it injects a venom that is acidic in nature (formic acid). It causes pain and irritation.
- ii. A base is applied typically to neutralise the acid.
- iii. Usually, calcium hydroxide (slaked lime), which is readily available in households, or baking soda is used to neutralise the acid.

#### Wasp bite:

- i. When we are bitten by wasp, we feel the burning sensation and pain. It is due to an alkaline substance injected by the insect.
- ii. To neutralise the alkalinity we use vinegar which is an acid.

#### Tooth decay:

- i. Bacteria present in food particles get stuck in the gaps between teeth. They produce acids when decomposing. Such acids are the reason for tooth decay.
- ii. So we use toothpaste to brush our teeth every day. All toothpastes have weak bases such as sodium fluoride, sodium carbonate, etc. Such bases neutralize the acids and protect teeth.

#### Antacids:

- i. We know that our stomach has concentrated hydrochloric acid to digest food. Sometimes, due to various reasons, the acidity increases.
- ii. When the acidity is increased, it burns the food pipe and causes ulcers.

- iii. To neutralize this, antacids like milk of magnesia (magnesium hydroxide) and aluminium hydroxide are used.

#### Soil treatment:

Plants do not tolerate acidic soil much. Nature of the soil is very important for agriculture. So, lime (CaO) or limestone (CaCO<sub>3</sub>) or wood ash is added to the soil by farmers to neutralise the acidity.

#### Effluent treatment:

- i. The sewage or liquid wastes that are produced from industries are called 'effluents'. This is highly acidic in nature. Lime is added to it to neutralise it before adding it to the waterbodies like rivers.
- ii. In power stations, fossil fuel (coal - carbon) is burnt to produce electricity. While burning, sulphur dioxide is released. This gas is acidic in nature. So, this gas is treated with powdered lime (CaO) or limestone (CaCO<sub>3</sub>) before letting it mix with air. This prevents air pollution.

**Note:** Any of the above four reactions can be chosen for the answer.

- 4. Natural indicators are chemical substances which are obtained from the natural resources. Litmus, turmeric juice, China rose petals, red cabbage, grape juice and beetroot juice are the indicators obtained from natural resources.

#### Preparation of a natural indicator from turmeric powder:

- i. Mix turmeric powder with water to make into a paste.
- ii. Soak a filter paper or blotting paper in this paste and dry.
- iii. These strips are used as indicators to find the nature of the solution.
- iv. When these strips are immersed in an acidic solution, this does not show any change in colour.
- v. But with a basic solution, the colour changes from yellow to red.

- 5. Refer question no. 3 for answer

## VI. Higher Order Thinking Skills (HOTS):

1. Lemon rice has citric acid and curd rice has lactic acid, giving them a sour taste as acids are sour to taste.
2. The tooth caries is formed due to action of acids on enamel surface. Dental caries (cavities) are the most common form of oral disease known to man, and the process of getting caries is called tooth decay.

Tooth decay is the destruction of your tooth enamel -- the hard, outer layer of your teeth. This issue can affect children, teens and adults.

Plaque, a sticky film of bacteria, is constantly forming on your teeth. When you eat or drink foods or beverages containing sugars, the bacteria in plaque produce acids that attack tooth enamel. The stickiness of the plaque keeps these acids in contact with your teeth, and over time the enamel can break down.

So we use toothpaste to brush our teeth every day. All toothpastes have weak bases such as sodium fluoride, sodium carbonate, etc. Such bases neutralize the acids and protect teeth. So, due to the tooth decay, Heshna has teeth with caries.

3.  $2\text{HNO}_3(\text{aq})$  and  $\text{Ba}(\text{OH})_2(\text{aq}) \longrightarrow \text{Ba}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$   
 $\text{H}_3\text{PO}_4(\text{aq})$  and  $\text{Ca}(\text{OH})_2(\text{aq}) \longrightarrow \text{Ca}_3(\text{PO}_4)_2 + 2\text{H}_2\text{O}$

## Chapter - 15 CHEMISTRY IN EVERYDAY LIFE

### I. Choose the correct answer:

1. d) mercaptan
2. b) water gas
3. c) kilo joule per kilo gram
4. d) Anthracite
5. a) methane

### II. Fill in the blanks:

1. carbon monoxide and nitrogen
2. methane
3. rock oil
4. destructive distillation of coal
5. coal

### III. Match the following:

- |               |                            |
|---------------|----------------------------|
| 1. c – petrol | 3. b – methane             |
| 2. a – diesel | 4. e – first stage of coal |
|               | 5. d – brown in colour     |

### IV. Answer briefly:

1. The property of carbon atom to form bonds with itself resulting in a single large structure or chain is called catenation.
2. **Advantages of natural gas:**
  - i. Natural gases are environmental friendly gases as they burn cleaner compared to other fossil fuels.
  - ii. It is cheaper and easy to extract.
  - iii. It is safer when transported and stored.
3. CNG – Compressed Natural Gas.

#### Uses of CNG:

- i. It is the cheapest and cleanest fuel.
  - ii. Vehicles using this gas produce less carbon dioxide and hydrocarbon emissions.
  - iii. It is less expensive than petrol and diesel.
4. Water Gas, a gaseous mixture of carbon monoxide and hydrogen is known as syngas. It is called so as it is used to synthesise methanol and simple hydrocarbons.
  5. Being the higher grade coal with fewer impurities, Anthracite is a dark black and hard coal containing 86% -97% of carbon content.
    - i. It has a higher heat capacity and a lighter weight.

- ii. Due to their stronger property, in contrast to the other types, this coal burns longer producing more heat with less dust.
- iii. It is a high value product making it more expensive to be used in power plants. Therefore, it is used only as a domestic fuel.
- iv. On the strength of its purity, anthracites can be categorized into high grade (HG) and ultra-high grade (UHG).

#### 6. Differences between octane number and cetane number:

| Octane Number                                                          | Cetane Number                                                 |
|------------------------------------------------------------------------|---------------------------------------------------------------|
| Octane rating is used for petrol.                                      | Cetane rating is used for diesel.                             |
| It measures the amount of octane present in petrol.                    | It measures the ignition delay of the fuel in diesel engines. |
| Octane number of petrol can be increased by adding benzene or toluene. | Cetane number of diesel can be increased by adding acetone.   |
| The fuel with a high octane number has a low cetane number.            | The fuel with a high cetane number has a low octane number.   |

7. Wind energy is obtained with the help of wind mills. When wind blows, they rotate the blades of the wind mills and current is produced in the dynamo. Wind mills are mostly located at Kayathar, Aralvaimozhi, Palladam and Kudimangalam in Tamil Nadu producing 1,500 MW in capacity.
8. Solar energy is the only viable fuel source of non-depleting energy as
  - i. it is derived from the sun that makes life possible on our earth and the radiations are continuous or never ending.
  - ii. it is a renewable source of energy as the Sun is source of this energy.
  - iii. it a potential source of energy that doesn't endanger the environment and can replace the fossil fuel to meet the needs of the world.

#### V. Answer in detail:

1. Coal is a fossil fuel formed from peat, a plant matter which was compressed to high temperature and pressure. It is a non-renewable source of energy as its formation takes several decades.

On the basis of amount of carbon content and amount of heat energy produced, coal can be classified into four major categories namely lignite, sub-bituminous, bituminous and anthracite.

**Lignite:** It is a low grade, brown colour coal containing a very less amount of carbon content of about 25 % – 35%. This coal is considered to be the most harmful to health, compared to the other types. It has higher moisture content and ash ranging from 6 % – 19% from the other types. Due to its volatility it can be easily converted to gas and liquid petroleum products.

Unfortunately, the presence of high moisture content makes it susceptible to spontaneous combustion, making it difficult to transport. On the other hand, due to their specific properties lignite is environmentally beneficial for cultivation and as alternates to chemical pesticides.

**Sub-bituminous:** As a result of hardening and darkening of lignite coals sub-bituminous coal is formed. It is a black and dull coal containing more carbon content of about 35%–44% than lignite.

Moisture content of this coal ranges from 15% - 30% with relatively less density, and it is more susceptible to spontaneous combustion. However, it has lower sulphur content than the other types, which allow sit to burn clearly. Thus, this unique property of sub-bituminous coal allows it to be used in certain power plants, aiming to reducethe SO<sub>2</sub> emission considering acid rain.

**Bituminous:** It is a tar like dark and dense sedimentary rock formed as a result of changes in physical and chemical composition of sub-bituminous rock.

It often appears with sharp bands of bright and dull material. The carbon content is higher than that of the lignite of about 45 to 86 % and has a higher heat capacity. Thus, this coal is used to progenerate electricity in steam electric power stations. In addition, coke used to manufacture steel and iron is obtained from bituminous coal.

**Anthracite:** Being the higher grade coal with fewer impurities, Anthracite is a dark black and hard coal containing 86%-97% of carbon content.

- i. It has a higher heat capacity and a lighter weight.
- ii. Due to their stronger property, in contrast to the other types, this coal burns longer producing more heat with less dust.
- iii. It is a high value product making it more expensive to be used in power plants. Therefore, it is used only as a domestic fuel.
- iv. On the strength of its purity, anthracites can be categorized into high grade (HG) and ultra-highgrade (UHG), which are majorly found in countries like Russia, Ukraine, South Africa and USA.

2. **Destructive distillation:** Coal when heated in the absence of air does not burn but produces many by-products. This process of heating coal in the absence of air is called destructive distillation of coal.

#### Products obtained from petroleum:

The crude petroleum obtained from the well is a dark colored viscous liquid which contains many impurities such as water, solid particles and gases like methane and ethane. To make it useful for different purposes, it must be separated into various components. The process of separating petroleum into useful by-products and removal of undesirable impurities is called refining. The steps involved in this process are given below.

1. Removal of water
2. Eliminating sulphur content

#### 3. Fractional distillation

Products obtained from petroleum after fractional distilling it are

- i. Liquefied Petroleum Gas or LPG is used in houses as well as in industries.
- ii. Petrol is used as a solvent for dry cleaning.
- iii. Diesel and petrol are used as fuels for vehicles. They are also used to run electric generators.
- iv. Kerosene is used as a fuel for stoves and also in jet planes.
- v. Paraffin wax is used to make candles, ointments, ink, crayons, etc.
- vi. Bitumen or asphalt is mainly used to surface roads.
- vii. Lubricating oil reduces wear and tear and corrosion of machines.

3. Any material that can be used to produce heat and energy on burning or reacting with other substances is called fuel.

Fuels can be classified into three major types based on the physical state they exist in. Physical state includes solid, liquid and gas.

#### Solid Fuel

Fuels that exist in solid form are called solid fuels. These include wood and coal that produce heat when burnt. Solid fuels are the first type of fuel used by mankind. It is considered to be the cheapest and easily portable fuel as it can be transported and produced easily with less cost.

#### Liquid Fuel

Almost all the liquid fuels are derived from fossils of dead plant and animal matter. These fuels give more energy on heating compared to solid fuels and burn without ash. Some examples of liquid fuels include petroleum oil, coal tar and alcohol.

#### Gaseous Fuel

Gaseous fuels are pollution free gases. It can be transported easily through pipes to the place of consumption. Some common gaseous fuels include hydrogen, coal gas, oil gas and producer gas. In addition, gaseous fuels are considered sources of

potential heat or light energy.

### Alternative fuels

- i. **Bio diesel** is a fuel obtained from vegetable oils such as soya bean oil, jatropha oil, corn oil, sunflower oil, cotton seed oil, rice-bran oil and rubber seed oil. Some applications of bio-diesel include usage in trains and cars.
- ii. **Wind energy:** When the wind blows it mechanically activates the turbine and rotates. When the turbines of the wind mills rotate this mechanical energy is converted to electric energy in the dynamo. It is a more sustainable and renewable source of energy and has a much smaller impact on the environment.
- iii. **Gobar gas** is obtained by the fermentation of cow dung in the absence of air (anaerobic conditions). It mainly contains methane and a little ethane. It is widely used in rural areas for cooking and operating engines.
- iv. **Solar Energy:** The sun is the major source of energy that supports life on Earth. Energy flow starts from obtaining heat and light energy from the sun. Solar energy is a clean, non-depleting, free and renewable source of energy as the energy flow is continuous.

The light and heat from the sun is harnessed from the sun using evolving technology, which has now become easily affordable. It is the most efficient way of harvesting energy as minimum effort using various equipment can produce immense energy.

### VI. Higher Order Thinking Skills (HOTS):

1. When coal is heated in the absence of air it does not burn, but it produces a few by-products. This process is known as destructive distillation of coal. The important by-products of the reaction are coke, oils, coal gas and ammonia.

Ultimately, only a black residue called coke is left.

Coke is a black porous solid and contains 98% of carbon. It is the purest form of coal. It is an excellent fuel as it burns without smoke and

has high calorific value if high. Its industrial application includes extraction of metal from its ores as it is a reducing agent.

2. Coal is another form of fossil fuel formed from peat, a plant matter. Over million years ago, when this peat, the precursor of coal, was subjected to high temperature and pressure underground, it decayed to convert itself to coal.

Coal appears in brownish-black or black rock coal seams, which is highly combustible. Coal is mainly carbon with varying amount of hydrogen, sulphur, oxygen, and nitrogen. The varieties of coal are:

**lignite** - is a low grade, brown colour coal containing a small amount of carbon content of about 25%–35%. This coal is considered to be the most harmful to health, compared to the other types of coal as it has higher moisture content and ash ranging from 6–19%.

Besides being used as a low grade fuel, it can be easily converted to gas and liquid petroleum products.

**Sub-bituminous** - hardening and darkening of lignite forms sub-bituminous coal. It is a black and dull coal containing carbon content of about 35%–44%.

Moisture content of this coal ranges from 15%–30%. This variety is more susceptible to spontaneous combustion. However, it has lower sulphur content than the other types of coal which allows it to burn clearly.

**Bituminous** - is a tar like dark and dense sedimentary rock formed as a result of changes in physical and chemical composition of sub-bituminous rock. It often appears with sharp bands of bright and dull material. The carbon content is higher than that of the lignite of about 45 to 86 % and it also has a higher heat capacity. This coal is used to generate electricity in steam electric power stations.

**Anthracite** is a dark black and hard coal containing 86%–97% of carbon content. It has a higher heat capacity and a lighter weight. Anthracite burns longer producing more heat with less dust. It is more expensive and suitable as a domestic fuel.

3. Fossil fuels such as coal, petroleum, natural gas are carbonaceous. Burning of fossil fuels produces gases like  $\text{CO}$ ,  $\text{CO}_2$ ,  $\text{SO}_2$ ,  $\text{NO}_2$ . This causes air pollution. Also if we burn any fossil fuel in the presence of insufficient supply of oxygen carbon monoxide and unburnt hydrocarbons get released into the atmosphere which is harmful for human health. If we burn fossil fuels in the presence of sufficient supply of oxygen it releases Carbon dioxide which absorb harmful radiation which is emitted by the earth which increase temperature of earth and cause Global Warming.
- (i) Presence of  $\text{CO}_2$  in large amount leads to global warming.
  - (ii) Presence of  $\text{SO}_2$  and  $\text{NO}_2$  in larger amount causes acid rains which damages both crops and buildings made-up of marble.

## VII. Value based question:

1.
  - a. If it is not possible to walk, riding a bicycle is the best mode of transport.
  - b. By seeking non-conventional fuels such as wind, water and solar energy.
  - c. Radha is helping to preserve the environment. She is a responsible citizen.

**V. Consider the statements labelled as Assertion and Reason and choose the correct option:**

1. b.                      2. d.

**VI. Answer in one or two sentences:**

1. The names of nitrogen fixing bacteria are Rhizobium, Azotobacter and Clostridium.
2. The bacteria used in the production of vinegar is Acetobacter aceti.
3. Three protozoans are amoeba, paramecium and euglena.
4. Sir Alexander Fleming discovered penicillin.
5. The diseases that can be prevented by vaccination are tuberculosis, diphtheria, pertussis, tetanus, polio, measles, mumps, rubella and typhoid.

## VII. Answer briefly:

1. Based on their shape bacteria have been classified as Cocci (spherical shaped), Bacilli (rod shaped), Spirilla (spiral shaped), Vibrio (comma shaped).
2. Antibiotics are drugs or medicines which inhibit the growth of microorganisms. These chemicals are extracted from microorganisms like bacteria, fungi, etc.
3. Organisms which cause diseases are called pathogens. Virus, bacteria, fungi, protozoa

## Chapter - 16 MICROORGANISMS

1. c) micron
2. b) virus
3. d) bacteria
4. c) 4
5. b) thallus

## II. Fill in the blanks:

1. Penicillin
2. Prion
3. Virion
4. microscope
5. monotrichous

**III. Match the following:**

1. Nitrogen fixing bacteria Rhizobium

and some worms are such disease causing organisms.

4. Disease causing bacteria enter the body through different means; through the skin, the nose, the mouth, etc.
5. Microorganisms like bacteria and fungi play an important role in maintaining soil fertility in agriculture. Saprophytic bacteria play an essential role in converting dead plants and animals into nitrates, nitrites and ammonia. Examples of bacteria that enrich the soil are nitrifying bacteria, ammonifying bacteria and nitrogen fixing bacteria. Bio fertilizers, are bacteria like Rhizobium, Azotobacter and other organisms like fungi, that enrich the nutrient content and quality of the soil.

### VIII. Answer in detail:

1. A bacterium is a single-celled prokaryote. A rigid cell wall gives it shape and encloses nuclear material and cytoplasm. A thin cell membrane lies beneath the non-living cell wall. Since it is a prokaryotic cell, it lacks membrane binding organelles like mitochondria, golgi bodies, etc. Ribosomes are present and they carry out protein synthesis. A nucleus is absent. The nuclear material is bacterial DNA, which is present in the cytoplasm, without any nuclear membrane. It is a single strand of circular DNA found in a region of the cytoplasm called the nucleoid. Some bacteria also contain extra rings of DNA called plasmids in the cytoplasm.
2. Microorganisms are used in the manufacture of medicines, antibiotics and vaccinations. Antibiotics are drugs or medicines which inhibit the growth of microorganisms. These chemicals are extracted from microorganisms like bacteria, fungi etc. Today antibiotics are used widely to treat all types of diseases. Vaccines are preparations of dead or weakened microbes. They help your body identify an infection and stimulate the body to use its natural defence system against it. The body produces its own antibodies to fight the microbes.
3. Organisms which cause diseases are called pathogens. Virus, bacteria, fungi, protozoa and some worms are such disease causing

organisms. They cause diseases like cholera, pneumonia, swine flu and rat fever. Disease causing organisms must first enter the body in order to cause any infection. Bacteria causing tuberculosis, and viruses causing cold and influenza enter through the nose and reach the respiratory tract. Bacteria causing typhoid enter through the mouth and go to the gut. Some organisms directly go through the skin like the spores of the fungus which causes ringworm. Some microorganisms are carried by carriers or 'vectors'. For example, mosquito is a vector which carries the malarial parasite Plasmodium.

4. We improve the beneficial bacterial count in human beings by taking probiotics. Probiotics are live microorganisms very similar to the good bacteria that are found in the intestine. They are either taken as food supplements or are found naturally in foods like yogurt and fermented milk products. Eg. Lactobacillus acidophilus, Bifidobacterium bifidum and Bifidobacterium breve.
5. Probiotics are live microorganisms very similar to the good bacteria that are found in the intestine. They are either taken as food supplements or are found naturally in foods like yogurt and fermented milk products. Eg. Lactobacillus acidophilus, Bifidobacterium bifidum and Bifidobacterium breve. Because they improve the microbial spectrum in the gut they are useful in the treatment of various gastrointestinal disorders like irritable bowel syndrome, childhood constipation, etc. They also help to decrease the risk of colon cancer and decrease cholesterol absorption. Bifidobacterium bifidum has been found to be useful in treating stomach ulcers.

## Chapter - 17 PLANT KINGDOM

### I. Fill in the blanks:

1. taxis, nomos
2. Carolus Linnaeus
3. Bentham and Hooker
4. One

5. Phaeophyta
6. Red
7. Glycogen,oil
8. Pteridophytes
9. Bryophytes
10. Dicots

## II. Choose the best answer:

1. b) Genus
2. c) Volvox
3. c) Rhodophyceae
4. b) Agaricus
5. c) Bryophytes
6. b) Pteridophytes
7. b) Pteridophytes
8. d) 1623
9. b) Fungi

## III. Match the following:

1. Which of the following pairs are incorrect?  
2) c, d
2. Find out the correct pairs  
4) a, b, d
3. Which of the following characters are not suitable to angiosperms?  
2) b, c
4. Which of the following sequences are correct:  
1) a, b, c
5. Match column I with column II:  
1) a-4, b-5, c-2, d-3, e-1

## IV. State True or False. If false, correct the statement:

- |          |          |           |
|----------|----------|-----------|
| 1. True  | 5. False | 9. False  |
| 2. False | 6. False | 10. True  |
| 3. False | 7. True  | 11. True  |
| 4. True  | 8. True  | 12. False |

## V. Answer in one or two sentences:

1. A thallus is when the plant body is not well differentiated, i.e. it does not possess a well developed root, stem and leaves.
2. Carolus Linnaeus, introduced the system of Binomial nomenclature. Local names were substituted with scientific names. A two part name is used for each species. The first part of the name is the genus and the second part is the name of the particular species of the genus. Example - the name for tiger is *Panthera tigris*.
3. Plants with seeds having two cotyledons are known as dicotyledonous plants or dicots. Leaves have reticulate venation. They have a fibrous root system. The flowers are pentamerous, calyx and corolla well differentiated. Pollination is mostly by insects. Vascular bundles are in rings. (any three of the above are correct)
4. Seeds of gymnosperm plants are naked because the ovules are not enclosed in an ovary.
5. Two economic importances of fungi are as follows: mushrooms are widely cultivated and eaten as they are a rich source of protein and minerals. Penicillin is an antibiotic obtained from the fungus, *Penicillium notatum*. Cephalosporin, Neomycin, Erythromycin and Gentamycin are other antibiotics derived from fungi.

## VI. Answer briefly:

1. In the Natural system of classification plants with many similar characteristics are grouped together. By simply listing out the different characteristics of a plant you will be able to identify the natural group to which it belongs. Natural similarities, differences and relationships are considered in this system that is used to classify plants in herbariums and botanical gardens.

The Bentham and Hooker's classification, based on morphological and reproductive characters of seeded plants, is an example of this system.

2. Three economic importances of algae are:

- Marine algae or sea weeds are a source of food and form the basis of the aquatic food chain.
- Algae are also eaten by people in different parts of the world.
- Algae release a good amount of oxygen through their food manufacturing activity.
- Agar-agar is a gelatinous substance derived from red algae, Gelidium and Gracilaria.
- The mineral iodine, essential for the normal functioning of the thyroid gland, is obtained from Laminaria, a brown algae and also from Gracilaria.
- Algae, are grown in long term space flights, to recycle the CO<sub>2</sub> in the air, turning waste generated into fuel, etc.
- Blue green algae (BGA) are grown in rice fields to fix atmospheric nitrogen.
- Algae act as bio filters and are used to treat waste water.
- Spirulina (*Arthrospira platensis*), a blue green algae is cultivated for its nutritional value. (any three of the above are correct)

3. The differences between algae and fungi are as follows:

| Fungi                                            | Algae                                  |
|--------------------------------------------------|----------------------------------------|
| Heterotrophic organisms                          | Autotrophic organisms                  |
| Belong to their own Kingdom Fungi                | Belong to Kingdom Protista             |
| Terrestrial                                      | Mostly aquatic                         |
| Most are parasitic                               | Not parasitic                          |
| Don't contain any photosynthetic pigments        | Contain chlorophyll for photosynthesis |
| Cell wall mainly of chitin                       | Cell wall mainly of cellulose          |
| Reserve food stored as glycogen and oil globules | Reserve food stored as starch          |

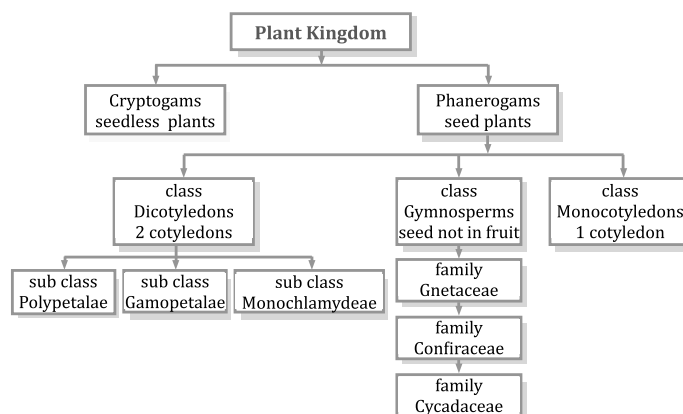
4. Bryophytes are classified into three main types, Hepaticopsida, Anthoceropsida and Bryopsida.

5. The four characters of pteridophytes are as follows:

The main plant body, the sporophyte, is differentiated into stem, roots and leaves. This is the dominant phase. They show alternation of generations; the sporophyte producing spores, which alternates with the gametophyte producing gametes. The gametophytic generation does not depend on the sporophytic generation. They have leaves known as 'fronds' (sporophylls). In certain plants the leaves can reach upto 6 metres in length. The lower surface of the leaves have sori (singular-sorus), which are like pockets, inside which sporangia are present. Sporophytes produce spores which may be homosporous or heterosporous. Leaves may be microphylls as in Selaginella, or macrophylls as in ferns. They have a special stem called a 'rhizome' which grows horizontally below the ground. (any four of the above are correct)

## VII. Answer in detail:

1. The Bentham and Hookers system of classification is as follows:



2. The differences between monocot and dicot plants are as follows;

|             | Monocots          | Dicots              |
|-------------|-------------------|---------------------|
| Seeds       | One cotyledon     | Two cotyledons      |
| Leaves      | Parallel venation | Reticulate venation |
| Root system | Tap root system   | Fibrous root system |

|                  |                                                      |                                                    |
|------------------|------------------------------------------------------|----------------------------------------------------|
| Flowers          | Trimerous, calyx and corolla not well differentiated | Pentamerous, calyx and corolla well differentiated |
| Pollination      | Mostly by wind                                       | Mostly by insects                                  |
| Vascular bundles | Scattered                                            | In rings                                           |

(any five of the above are correct)

3. The differences between Gymnosperms and Angiosperms are as follows:

Angiosperms can be herbs, shrubs, trees, climbers, creepers, etc. They have well developed root and shoot systems with conducting tissues (xylem and phloem). Xylem conducts water and minerals, and phloem translocates the prepared food from leaves to the other parts of the plant. They show secondary growth due to the presence of cambium tissue. Seeds are enclosed inside the fruit. The ovules develop into seeds and the ovary into the fruit. Plant embryos inside the seeds have cotyledons.

Gymnosperms are evergreen and woody, like pine and fir. The plant body is well differentiated into stem, roots and leaves. They have a well developed tap root system. They are heterosporous, i.e. they produce different male and female spores. They bear male and female cones, which are reproductive structures.

Gymnosperms have sporophytic and gametophytic phases in their life cycle.

Trees from this group undergo secondary thickening.

4. The economic importance of gymnosperms is as follows:

- Soft wood comes from pine, fir, cedar, etc., which is used in construction and for making planks, packing cases, match sticks and wood pulp for the paper industry.
- Turpentine oil and resin are extracted from Chir pine.
- Thuja, Cycas and Araucaria are grown as ornamental plants.

- Ephedra is used in treating bronchitis and asthma.
- Resins obtained from gymnosperms are used in varnishes, enamels and medicines. Some inferior grade resins are used in printing ink, insecticides, adhesives, shoe polish, etc.
- 'Sago' is obtained from some species of Cycas.
- Thuja oil obtained from the leaves is used in room sprays, insecticides and disinfectants.

5. The leaves of Aloe vera are used in the treatment of burns, skin diseases, inflammatory skin conditions, gum disease, piles and peptic ulcers.

- Basil leaves are used to treat cold, cough, skin diseases.
- Neem (Vembu) leaves are used as an antiseptic, to destroy worms and to prevent skin diseases.
- Turmeric (Manjal) an underground stem is said to prevent cancer, and used as a cosmetic and an antiseptic.
- Acalypha indica (kuppameini) leaves with lemon juice cures ringworm.
- Aegle marmelos – Indian Bael is used to treat indigestion, fever, diarrhoea, body pain.
- Amla (Nelli) fruit is a rich source of Vitamin C, cures mouth ulcers.
- Solanum trilobatum (Thoodhuvalai) the leaf and fruit are used in the treatment of coughs, colds, asthma, bronchitis.
- Ginger (Inji) used in treatment of digestive disorders.
- Cinchona Bark cures malaria.
- Phyllanthus amarus Carry Me Seed (Keezhaneli) leaves used to treat jaundice and other liver diseases.
- Climbing Brinjal (Thuthuvalai) leaves are used to cure cold and cough.
- Eucalyptus leaves are used to cure cold and sinus problems.
- Poppy seeds are used as pain killers.
- Pepper seeds are used to treat coughs and throat infection.

**VIII. Consider the statements labelled as Assertion and Reason and choose the correct option:**

1. a) Both A and R are true, R explains A
2. c) A is correct R is incorrect
3. c) A is true, R explains A
4. c) A and R correct R explain A
5. b) Both A and R are true, R doesn't explain A

## **Chapter - 18 ORGANISATION OF LIFE**

**I. Fill in the blanks:**

1. Cell
2. Ostrich
3. Yeast
4. Optic
5. Micron

**II. Choose the best answer:**

1. a) Sclera
2. a) Homeostasis
3. a) Lactic acid
4. b) Stem
5. c) Breathing
6. a) Higher concentration to a region of lower concentration
7. a) Hypotonic
8. d) 1623
9. b) Fungi

**III. Arrange the following words in correct sequence:**

Cell, Tissues, Organ Organ system, Organism

**IV. Match the following:**

1. Match the following examples for catabolism.
  - a. Carbohydrates- glucose
  - b. Glucose -  $\text{CO}_2$ , water and heat
  - c. Protein - amino acid
2. Match the following examples for anabolism:
  - a. Glucose -glycogen and other sugars
  - b. Amino acids - enzymes, hormone, protein
  - c. Fatty acids - cholesterol and other steroids

**V. State True or False. If false, correct the statement:**

1. False - In hypotonic condition, concentration of the external solution is lower than the internal solution of the organism.
2. False - Diffusion is the movement of particles from an area of higher concentration to Lower concentration.
3. True
4. True
5. False - Vitreous humour plays an important role in maintaining the shape of the eye.

**VI. Answer in one or two sentences:**

1. The foetus is made up of a multitude of cells, each with a different size, shape, and content. These cells within the foetus gradually undergo a change in structure and function. This is termed cell differentiation.
2. Animal tissues can be broadly classified into four types based on their function. They are:
  - Epithelial tissue
  - Muscular tissue
  - Connective tissue
  - Nervous tissue
3. The bronchioles that enter the lungs finally end in bunches of tiny air sacs called alveoli. These alveoli are large in number and are closed, thin-walled and richly supplied with blood capillaries. The thin walls of the alveoli allow the exchange of gases to take place through them.
4. Breathing, consisting of inspiration and expiration, are the processes by which air enters and comes out of our lungs.
5. Osmoconformers are organisms that try to maintain the osmolality of their body to match with their surroundings. Most invertebrates and marine organisms are osmoconformers. Osmoregulators are organisms that maintain their internal osmolality, which could be extremely different from that of the surrounding environment through physiological processes.
6. Metabolism refers to all the chemical reactions that occur in living organisms. Metabolism involves utilization or release of energy. Metabolism is usually divided into two categories – anabolism and catabolism.

## VII. Answer briefly:

1. Organisms in which no true nucleus is seen are called prokaryotic. Ex: Bacteria.
2. Organisms in which true nucleus is seen (presence of nuclear membrane) are called eukaryotic. Ex. Higher plants.

### 3. Aerobic:

- Aerobic respiration takes place in the presence of oxygen.
- The end products of aerobic respiration are carbon dioxide and water.
- Common in all higher plants and animals.

### Anaerobic:

- Anaerobic respiration takes place in the absence of oxygen.
  - The end products of anaerobic respiration are  $\text{CO}_2$  and ethanol or lactic acid.
  - Common in certain microorganisms and human muscle cell.
4. The epithelial tissue is a tissue which acts as a covering and protects the underlying tissues. It is classified into the following types.

- i. Squamous epithelium
- ii. Cuboidal epithelium
- iii. Columnar epithelium
- iv. Ciliated epithelium
- v. Glandular epithelium

5. The human eye can be compared to a camera as both functions by gathering, focusing and transmitting the light through the lens for creating an image of an object.

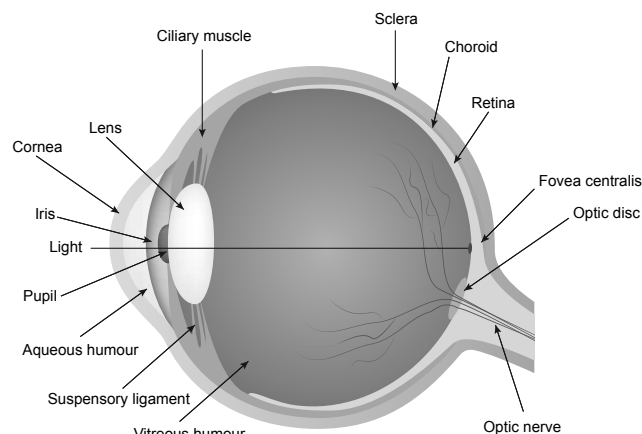
- The iris of the eye controls the size of the pupil depending on the amount of light entering it.
- The pupil is like the eyehole of a camera which allows light to come in.
- **Lens:** It is a transparent, biconvex and an adjustable part of an eye, made the retina, therefore creating images on it.
- The retina consists of photoreceptors and converts light rays into impulses to be sent to the brain. It is light sensitive.
- The retina is compared to the film in a camera.

6. Homeostasis is a property of a human biological system where the self-regulating process tends to maintain the balance for the survival.

- Behavioural and physiological responses are two important regulating mechanisms that maintain the stability of homeostasis.
- All the processes of integration and co-ordination of function are mediated by nervous and hormonal system. The liver, kidneys and brain (hypothalamus), autonomic nervous system and the endocrine system help to maintain homeostasis.

## VIII. Answer in detail:

1. V.S of human eye.



2. Osmosis is the movement of solvent molecules from a region of higher concentration of solvent molecules to a region of lower concentration of solvent molecules across a semi permeable membrane. Water moves in and out of cells across the cell membrane which is semi permeable due to osmosis. Example-When human cells like red blood cells are placed in a concentrated solution, they lose water and shrink and when they are placed in a dilute solution they gain water and can even burst. In normal water they remain the same.
3. Oxygen is taken in by the respiratory system from the air and is carried to different parts of the body by blood. The process of taking in air is called inhalation or inspiration. Oxygen, which is taken in during respiration, is used to break the digested food to produce energy. Carbon dioxide, which is produced during this

process, is eliminated out of the body. Giving out air that is rich in carbon dioxide is called exhalation or expiration.

4. Metabolism refers to all the chemical reactions that occur in living organisms.

Metabolism involves utilization or release of energy. Metabolism is usually divided into two categories – anabolism and catabolism. Anabolism is a constructive metabolic process, which is used to synthesize complex molecules from simpler components. Plants can construct complex substances like glucose from simple molecules like carbon dioxide and water. Growth and increase in muscle mass are examples of anabolism.

Catabolism is a process of breaking down of things. Here, complex molecules are broken down into smaller units with the release of energy. Catabolism provides energy for various activities in our body. The food that we eat is broken down into simpler substances with the release of energy, which is a catabolic process. Some other examples are the breaking down of fats into fatty acids and glycerol.

5. Breathing involves both inspiration (inhalation) and expiration (exhalation). During inspiration the diaphragm goes down, and the ribs move forward and expand. These two changes increase the volume of the chest cavity, which reduces the pressure inside the lungs and air rushes in. When we breathe out, the diaphragm moves up to its original position thereby, the ribs move down, decreasing the volume of the chest cavity. Due to this, the pressure inside the lungs increases and air is pushed out of the lungs through the trachea and nostrils of the nasal cavity.

6. **Read the given paragraph about human eye carefully and correct the mistakes.**

Our eye is spherical shaped. The wall of the eyeball is composed of three layers. The outermost layer is sclera. The innermost layer is called retina. The eyeball consists of fibrous tissue and a biconvex lens. The pupil is a small opening at the centre of the iris. Retina has

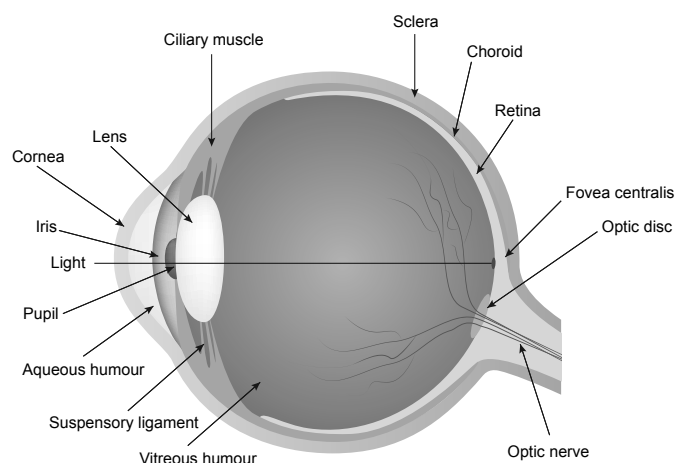
rod and cone shaped cells. Aqueous humour is present between cornea and lens.

The vitreous humour is present between lens and retina. The retina changes the light into nerve impulses and sends them to the brain.

**IX. Consider the statements labelled as Assertion and Reason and choose the correct option:**

1. c) A is true, R is false
2. a) Both A and R are true, R explains A

**X. Label the given diagram:**



## Chapter - 19 BODY MOVEMENTS

**I. Choose the best answer:**

1. (a) (i) and (iii)
2. (b) Snail
3. (c) Upper jaw and skull
4. (a) To swim easily in water
5. (b) cartilage
6. (a) leg
7. (a) Cervical – 7

**II. Fill in the blanks:**

1. locomotion
2. movement
3. skeleton
4. skull, sternum, ribs, vertebral column

5. shoulder (pectoral) girdle, pelvic girdle
6. joint
7. Non striated / Smooth / Involuntary muscle
8. Radial

**III. State True or False. If false, correct the statement:**

1. True
2. True
3. False. Pelvic girdle is a part of the appendicular skeleton.
4. True
5. False. Cardiac muscle is an involuntary muscle.
6. True.

**IV. Answer in one or two sentences:**

1. The human body is made up of a frame work of bones which helps in its movement. It is called the skeleton.
2. Eight bones of the skull are fixed together and form the cranium. These bones that form the cranium also called the brain box are connected together by immovable joints.
3. The vertebrae in the backbone are joined by gliding points that allow the body to bend backwards, forwards or sideways; slight movement.
4. The axial skeleton consists of all the bones along the central line or axis of the human body. The skull, facial bones, sternum, ribs, and vertebral column form the axial skeleton. The bones in the appendages as well as the structures that connect the appendages to the axial skeleton form the appendicular skeleton. The bones of the pelvic and pectoral (shoulder) girdle, and the bones of the upper limbs (hand, arm, wrist) and lower limbs (foot, ankle, leg) are a part of it.
5. Short bands of tough, flexible connective tissue that connect one bone to another are called ligaments.
6. Muscles are long bundles of contractile tissue that can contract and relax. They are important for movement in the body.

7. Ligaments are short bands of tough, flexible connective tissue that connect one bone to another. Tendons are fibrous elastic chords of tissues that attach muscle to bone

**V. Answer briefly.**

1. a.

| Movement                                                                            | Locomotion                                                 |
|-------------------------------------------------------------------------------------|------------------------------------------------------------|
| A change in the shape, direction, place, position, etc., of one or more body parts. | the ability of the body to move from one place to another. |
| Occurs at the cell, tissue and organisms level.                                     | Occurs only at the organism level.                         |
| It can be voluntary or involuntary.                                                 | It is only voluntary.                                      |

- b.

| Exoskeleton                                                                                  | Endoskeleton                                 |
|----------------------------------------------------------------------------------------------|----------------------------------------------|
| The skeleton that is found on the exterior layer of the body.                                | The skeleton that is found inside the body.  |
| It originates from the embryonic ectoderm or mesoderm.                                       | It originates from the mesoderm.             |
| It protects and preserves the inner organs.                                                  | Forms the main body structure and framework. |
| Examples are the scales in fish, feathers on birds and the outer hard layer of the tortoise. | Example - Almost all vertebrates.            |

- c. The pectoral girdle is formed by the collar bone (clavicle) at the front, and the shoulder blade (scapula) at the back. The collar bone is supported by the breast bone at one end and the shoulder blade at the other. The shoulder bone encloses a socket like cavity into which fits the ball of the upper arm forming a ball and socket joint.

The pelvic girdle is formed from strong bones as it balances the weight of the entire body. It is formed from five fused vertebrae at the back and it forms a cavity in the centre while it reaches the front. The three bones namely ilium, ischium and pubis are fused together. The femur or the thigh bone fits into the girdle on either side through a ball and socket joint.

d.

| Ball and socket joint                                                                        | Hinge joint                                                                   |
|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| The round ball shaped head of one bone fits into the hollow cup like socket of another bone. | The convex surface of one bone fits into the concave surface of another bone. |
| It allows rotational movement and the maximum range of movement, in three planes.            | It allows movement only in one direction. (bending and straightening only).   |
| Examples - hip and shoulder joint.                                                           | Examples - elbow, knee and ankle joints.                                      |

e.

| Voluntary/<br>Striated /Skeletal                      | Involuntary /<br>Non striated / Smooth                                                                                |
|-------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Attached to the bones<br>Found in arms, legs, neck.   | Attached to soft parts of the body like the walls of the internal organs, blood vessels, bronchi, iris, and the skin. |
| Long, slender, cylindrical, unbranched                | Spindle shaped                                                                                                        |
| Multinucleate, Striated dark and light bands.         | Single, central nucleus Non striated.                                                                                 |
| Voluntary                                             | Involuntary                                                                                                           |
| Movement of bones, holding the bones together, shape. | Movement of internal organs.                                                                                          |

- Most muscles work in pairs. They work against each other and are called antagonistic pairs. Examples are the biceps and triceps in the

upper arm. The biceps is bulging (contracted) on the upper arm, when we fold our arm at the elbow, and the triceps is found below the humerus or the bone of the upper arm, when it is relaxed. When the biceps contracts the lower arm is raised and the arm bends. In this position the triceps muscle is relaxed. The opposite happens when we extend or straighten the arm. The triceps contract and the biceps relax.

- All the features of the bird's body are designed for flight. The streamlined body offers least resistance while moving in the air. The skeleton is made up of pneumatic or hollow bones with air spaces between making them light but strong. This makes their body light and helps them in flight. Their forelimbs are modified into wings and the strong flight muscles attached to the wings; help them to flap their wings. Both the wings and the tail have long feathers to help them fly.
- The functions of the skeletal system are as follows:
  - The skeleton provides structure, shape and a framework to our body and gives it support.
  - It surrounds and protects delicate internal organs like the heart, lungs and the brain.
  - The bones help us to move our body as the skeletal muscles are attached to them. They act as levers for muscular action. Muscular movement would not be possible without tendons and ligaments.
  - The bone marrow is the seat of production of various blood cells.
  - Bones store various minerals like calcium and phosphorous that are required for regulatory functions in the body.

## VI. Answer in detail.

- Based on their movement, joints can be classified in the following manner.

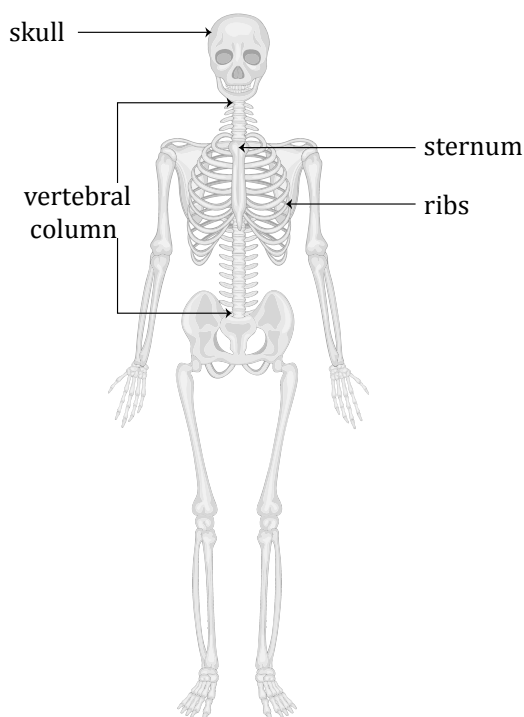
Fixed/ Immovable / Fibrous joints are joints allow no movement between the connected bones. The bones are held together, with the help of fibrous connective tissue. They do not have a synovial cavity. Bones of the skull are connected by these joints.

Cartilaginous / Slightly moveable joints are joints allow little movement between the

connected bones. The bones are held together with the help of a cartilage with no synovial cavity. Bones of the vertebra, and the ribs and the breast bone, are connected by these joints.

Freely movable joints are joints allow varying degrees of movement and easy movement between the connected bones. There are six major types of freely movable joints. Example ball and socket joint in the hip and shoulder.

2. The axial skeleton consists of all the bones along the central line or *axis* of the human body. The skull, facial bones, sternum, ribs, and vertebral column form the axial skeleton. The skull is positioned at the top of the backbone and can be moved upwards, downwards and sideways. It is hard and made up of small bones. There are 22 bones in all. Running down the back of the body in the trunk region is the vertebral column, also called the spine or the backbone. It supports the upper part of the body and is made up of 33 individual bones, called vertebrae. The ribs along with the vertebral column form a conical cage known as the ribcage. The ribcage protects the delicate organs like the heart, lungs, part of the liver and the upper part of the digestive canal. The sternum lies in the middle of the chest. There are 12 pairs of ribs attached to the sternum in front and the vertebral column at the back, forming the ribcage.



3. There are different types of movement seen in organisms, ciliary, flagella, amoeboid and muscular movement.

**Ciliary movement:** Cilia are tiny hair like processes that extend out from the epithelium. In lower organisms, they help in locomotion. In higher organisms, like man, some of the internal organs are lined with ciliated epithelium. They help in the movement of materials and fluids as is seen in the lymphatic system

**Flagellar movement:** Unlike cilia that cover the entire body of the organism, a flagellum is a thin, long, whip like structure seen usually at one end of the organism. Euglena and chlamydomonas are examples of organisms that move with flagella.

**Amoeboid movement:** This movement is seen in amoeba because of the streaming movement of the protoplasm within the organisms to form pseudopodia. It is also seen in some blood cells like leucocytes and macrophages.

**Muscular movement:** This type of movement is observed in humans and higher vertebrates that help them to move. The muscular and skeletal systems help with this movement.

4. A streamlined body means narrow at the ends and broad at the centre to reduce resistance through a stream of water or air. Fish have streamlined body help the fish to reduce friction and overcome the resistance offered by water while they swim. It helps them to move smoothly with the flowing water. Birds also have a streamlined body that helps them to reduce the friction and resistance offered while flying through the air.
5. Voluntary/ Striated /Skeletal muscles are attached to the bones and found in the arms, legs and neck. They are long, slender, cylindrical, unbranched. They are multinucleate, and striated with dark and light bands. They are voluntary muscles. The functions include movement of bones, holding the bones together and shape.

Involuntary / Non-striated / Smooth muscles are attached to soft parts of the body like the walls of the internal organs, blood vessels, bronchi, iris, and the skin. They are spindle shaped,

non striated with a single, central nucleus and involuntary. Functions include movement of internal organs. Cardiac muscles are found in the walls of the heart. They are branched, striated and involuntary with 1-3 central nuclei. Their function is to help in the beating of the heart.

## Chapter - 20 REACHING THE AGE OF ADOLESCENCE

### I. Choose the best answer:

1. c) 11 to 19                      3. b) girls
2. a) puberty                      4. c) larynx
5. c) sweat and sebaceous
6. a) Hormones                      8. c) ceased
7. b) LH hormone                      9. d) Calcium

### II. Fill in the blanks:

1. anti pituitary                      4. Iodine
2. menarche                      5. anemia
3. menstrual cycle

### III. State True or False. If false, correct the statement:

1. True
2. False – The release of the ovum from the ovary is called ovulation.
3. False-During pregnancy, the corpus luteum starts to degenerate and stops producing estrogen and progesterone.
4. False – Making use of disposable napkins or tampons decreases the chances of infections.
5. True

### IV. Match the following:

1. Puberty                      - Sexual maturity
2. Adam's apple                      - Change in voice
3. Androgen                      - Muscle development
4. ICSH                      - Testosterone
5. Menopause                      - at 45 to 50 years of age

### V. Answer briefly:

1. Adolescence is a transitional stage of human development, both physical and mental, occurring between puberty and adulthood. It is a transition period between childhood and adulthood.
2. The different changes that occur in puberty are; changes in body size, changes in body shape and proportion, change in voice, development of primary sex organs and development of secondary sex characteristics.
3. There are certain distinct features that appear during puberty and adolescence that cause dissimilarities between boys and girls. These are secondary sexual characteristics, and are due to hormonal changes that occur during puberty.
4. The stage of getting the first menstrual flow at the beginning of the first menstrual cycle is called menarche. It starts around the age of 12 years. At this time due to the onset of puberty, the ova begin to mature. It marks the beginning of adolescence, during which time physical growth is more pronounced and mental and emotional maturation occurs.
5. Cleanliness is very important during the time of the menstrual cycle and girls must take special care of cleanliness and personal hygiene to reduce the spread of germs and chances of catching any infections.

### VI. Answer in detail:

1. The physical changes that occur in boys and girls during adolescence are as follows:

#### Girls:

- Development of hair under the armpits (axillary hair), and in the pubic region
- Development and enlargement of the breasts
- Broadening and rounding of the hips due to the widening of the pelvic region and more fat deposition around the hip
- Increase in muscles, which gives shape to the arms, shoulders, and legs
- The voice becomes shrill
- Beginning of the menstrual cycle

- Like in boys, the skin becomes coarser and the pores enlarge

#### Boys:

- Development of facial hair such as a beard and a moustache
- Development of hair under the armpit, on the chest and in the pubic region
- The body becomes more muscular and broad shouldered because the strength of the muscles increases and it gives shape to the arms, legs and shoulders
- The voice changes and it becomes deeper and husky as the larynx enlarges. The volume increases and there is a drop in pitch
- Increase in body weight
- The skin becomes coarse and the pores in the skin enlarge

2. The ovaries and testes, which are part of the reproductive system, start secreting the sex hormones only at puberty. In males, the hormone testosterone helps in the production of sperm (male gamete). In females, the hormones, oestrogen and progesterone, are responsible for the maturity of the female gametes, i.e. the ova or eggs. Follicle Stimulating Hormone (FSH) in females is responsible for the growth and development of the Graafian follicle and the secretion of estrogen. In males it is required for the development of seminiferous tubules, and spermatogenesis. Luteinizing hormone in females is required for ovulation, and for the secretion of the luteal hormone progesterone. It is also required for the final maturation of the Graafian follicle. It stimulates the interstitial (Leydig) cells of testes in males and the secretion of testosterone and is therefore also known as the Interstitial Cell Stimulating Hormone (ICSH). Sperm is then actively produced. Sperm production in males begins at puberty and continues through life. The main function of prolactin (lactogenic hormone) is the secretion of milk during lactation. Oxytocin is responsible for the expulsion of milk from the mother's breast.

3. The menstrual cycle is as follows: begins with the shedding of the endometrium of the uterus and bleeding.

In females at puberty the sex hormones are released into the blood causing some of the ova in the ovaries to mature. Usually, every 28 days, one mature ovum is released from one of the ovaries. This is known as ovulation. Before ovulation the endometrium starts to thicken and is full of tiny blood vessels as it prepares to receive the fertilised egg. If no fertilisation takes place then the inner lining of uterus is no longer required and is shed. Along with the blood vessels and the unfertilised egg it comes out of the vagina in the form of a bleeding known as menstruation.

4. Nutritional needs are higher during adolescence than any other time in our life. Adolescents need a high calorie diet due to the growth and development spurt and increased physical activity that happens during that period.

Nutrition and physical growth are interrelated. If growing children or adolescent children are not given sufficient quantities of a high calorie, balanced diet with all the nutrients, it may not only result in retarded physical growth, but also reduces the intellectual development and delays sexual maturation. It should be balanced to combat any illness that can set in during that period.

Nutrition is also important to prevent diet related diseases like osteoporosis, cardiovascular problems, hypertension, etc.

A balanced diet contains all the nutrients proteins, carbohydrates, fats, minerals and vitamins in the required quantities. The diet of adolescents should be high in proteins that help in growth, apart from carbohydrates – the energy giving nutrient. They should consume considerable amount of fats and vitamins in the required proportions. They need basic minerals like calcium, iron, phosphorous, etc., in their diet. Apart from these, iodine is also essential.

## Chapter - 21 CROP PRODUCTION AND MANAGEMENT

### I. Choose the best answer:

1. b) sowing                      4. d) Sugar
2. a) bio-pesticides          5. c) soil treatment
3. b) surface irrigation

### II. Fill in the blanks:

1. transplanting              3. herbicides
2. weed                        4. heirloom seeds
5. Krishi Vigyan Kendras
6. Indian Agricultural Research Institute

### III. Match the following:

1. b - Bacillus thuringiensis
2. c - Control white flies
3. d - Improves soil fertility
4. e - Quality of environment
5. a - Neem Leaves

### IV. Answer briefly:

1. It is the process of loosening and mixing the soil from within. Also known as tilling, the soil is turned up and down to allow the nutrients to be available in the root zone of the plant.
2. The methods followed for sowing seeds are sowing by hand, sowing with a seed drill and dribbling.
3. A foliar spray is a liquid fertilizer applied directly to the foliage (leaves).
4. Farm science centres that serve as links between ICAR (Indian council of Agricultural research) and farmers are the Krishi Vigyan Kendras. They aim at applying agricultural research findings to practical localized settings.
5. Bio indicators or biological indicators are organisms like birds, bacteria lichens, etc., that are used to monitor the health of the environment. They may be a species or a group of species whose function or status reveals the qualitative status of the environment. They help us understand changes in the living systems on earth, especially changes caused due to human

activities and an increase in population and characterise the state of an ecosystem and its modifications.

6. Weeds are unwanted plants that grow naturally along with a cultivated crop in agricultural fields. Removal of weeds from a crop field is called weeding.
7. Crop rotation is a method of growing a series of different crops on the same piece of land in succession or following a defined order.
8. Green manure is any green undecomposed material that is used as manure. It is obtained by either growing green manure crops or by collecting the green leaves and twigs from trees grown in forests or wastelands.

### V. Answer in detail:

1. Students can refer to the chapter for this answer.
2. Water is essential for the proper growth and development of plants. Irrigation is the process of watering crops in the field at regular intervals according to their need. The frequency and the type of irrigation used depend on various factors like the type of crop, the season and the nature of the soil. Irrigation is essential at various stages of the growth of crops like development of aerial branches, flowering, fruiting, etc. Some of the sources of irrigation are wells, rivers, dams, canals, tube wells, lakes, ponds and reservoirs. For irrigation to be effective the supply of water to the crops must be controlled, uniform, in the required amount, at the right time and with the minimum expenditure. In our country, we use both traditional and modern methods of irrigation depending on the availability and the amount of water needed for the crops. Traditional methods of irrigation are usually carried out manually. They include the moat system, the lever or Rahat system, the dhekli system and the chain pump system. The main advantage of traditional methods of irrigation is that they are cheap. Modern methods facilitate the even distribution of water and moisture in the field. They are the sprinkler irrigation, drip irrigation, furrow irrigation and basin irrigation.

3. Weeds are unwanted plants that grow naturally along with a cultivated crop in agricultural fields. Growth of weeds in a field is harmful because they compete with the desired crop for water, sunlight, space and nutrients. Removal of the weeds from a crop field is called weeding. Some of the methods of weed control are as follows:

**Mechanical methods:** In this method weeds are manually removed by hand or by using a trowel or hand fork.

**Tillage method:** In this method the weeds are buried in the soil or exposed to sunlight by deep ploughing.

**Crop rotation:** Crop rotation is another method of getting rid of weeds that are associated with particular crops and parasitic weeds.

**Chemical methods:** Weeds are destroyed by spraying them with chemicals like 2, 4-D (2, 4-Dichlorophenoxy-acetic acid), Metachlor, Butachlor, etc. which are known as weedicides.

**Biological methods:** Bio agents like insects, pathogens or other organisms are put into crop fields with weeds. They eat the weeds, but do not harm the crops.

**Integrated weed management:** A new practice called 'integrated weed management' that combines different agronomic practices, and the use of weedicides and herbicides to manage weeds is now being used. This ensures that the farmers' dependence on any one weed control technique is reduced.

## Chapter - 22 CONSERVATION OF PLANTS AND ANIMALS

### I. Choose the best answer:

1. d) none of these
2. c) endemic
3. d) none of these
4. b) on site conservation
5. b) 1972

### II. Fill in the blanks:

1. World Wildlife Fund
2. Endemic
3. International Union for Conservation of Nature
4. The Nilgiris
5. March 3

### III. Match the following:

- |                    |                       |
|--------------------|-----------------------|
| 1. b - Gujarat     | 4. b - Uttarakhand    |
| 2. c - West Bengal | 5. a - Madhya Pradesh |
| 3. e - Tamil Nadu  |                       |

### IV. Answer in one or two sentences:

1. When solar energy falls onto the earth's surface, it is reflected back into the atmosphere. Part of this energy is trapped by the green house gases and sent back to the earth, keeping it warm. A part goes back into space. When green houses gases like carbon dioxide and methane accumulate in the atmosphere they trap more heat energy leading to an increase in temperature called global warming.
2. Extinct species are those like the dinosaurs, dodo, and some varieties of ferns and gymnosperms which no longer exist on Earth. These species may have disappeared because of shortage of space, food or most probably due to climatic changes
3. Dinosaurs, Dodo are examples of extinct species.
4. Students can name any two from the chapter.
5. IUCN stands for International Union for Conservation of Nature. It is an international organization working in the field of nature conservation and sustainable use of natural resources. It maintains the Red Data Book.

### V. Answer briefly:

1. Biosphere reserves are protected areas of around 5000 square kilometres where the human population also forms a part of the system. Set up mainly for economic development, they conserve the eco system, species and genetic resources.

2. Tissue culture is the technique of cultivating or the growing of plant or animal cells, tissues, organs, seeds or other plant parts in a sterile environment on a specially formulated nutrient medium. An entire plant can be regenerated from a single cell under the right conditions.

3. Animals and plants that are on the verge of extinction since their number is constantly decreasing are called endangered species. There are only few of them left on Earth, and soon even they may become extinct.

Deforestation and loss of habitat, environmental pollution, human interference, hunting and poaching have resulted in many species in India becoming endangered and some even extinct. Examples of endangered plants are malabar lily, Umbrella tree, Indian mallow, Rafflesia flower, Musli plant and of endangered animals are Snow leopard, Lion tailed macaque, Asiatic lion, Indian rhinoceros and Nilgiri tahr.

4. The advantages of the Red Data Book are it can be used to

- Evaluate the population of a particular species.
- Evaluate the species at the global level.
- Estimated the risk of a species becoming globally extinct.
- Provide guidelines to implement protective measures for endangered species.

5. The main reasons for the conservation of forests are:

- Forests provides a habitat, a place of protection and a source of food for several plant and animal species as well as people who live in forests. They provide fodder for cattle and other animals.
- Forests provide us with vital products that we use in our daily lives, directly or indirectly, like wood for timber, paper, fuel, firewood, sandalwood and a variety of medicines.
- They increase the amount of oxygen in the atmosphere.
- The water vapour in the atmosphere increases due to transpiration, and this helps in the water cycle and rainfall.
- Trees reduce the amount of carbon dioxide in the atmosphere. This effects air pollution, and

the amount of green house gases and global warming are controlled.

- The roots of trees prevent the top soil along with the nutrients from being washed away during heavy rainfall preventing soil erosion.

6. Our environment contains many toxic chemicals and contaminated substances. These include heavy metals like mercury and arsenic, and pesticides such as polychlorinated biphenyls and DDT (Dichlorodiphenyltrichloroethane). When organisms consume food they take in these substances. Biomagnification is the process in which toxic chemicals and other contaminated substances build up within organisms. It takes place across entire food chains and affects all organisms. For example, when a predator consumes its prey it consumes all the toxic substances in it. Animals higher up in the chain are therefore more affected as they feed on organisms lower down in the food chain and the toxic chemicals accumulate in them. There are therefore increasing concentrations of these toxic chemical in the tissues of organisms at successively higher levels in the food chain.

7. The People's Biodiversity Register is a document that contains complete information on availability and knowledge of locally available bio-resources of a particular area or village. It includes their medicinal or any other use, any traditional knowledge about them, as well as the landscape, demography.

According to the provisions of the Biological Diversity Act, 2000, each local body has a Biodiversity Management Committee set up that prepares the People's Biodiversity Register. This is done with the guidance and technical support of the National Biodiversity Authority and the State Biodiversity Boards.

The purpose of preparing this register is to promote conservation, preservation of habitat and breed of animals and microorganisms, and gather knowledge related to biological diversity.

It is a very useful tool in the management and sustainable use of bio resources and is also useful for teaching students environmental studies.

## VI. Answer in detail:

1. The destruction of forests to make land available for different purposes is known as deforestation. Deforestation may be the result of human activities or due to nature.

Deforestation can be caused naturally due to forest fires, cyclones, floods and severe drought.

Human activities responsible for deforestation are:

- to make space for agriculture
- urbanisation-building houses and infrastructure development
- industrialisation
- demand for wood as timber and for construction
- illegal logging
- producing firewood
- for fuel, and forest products like paper, sandalwood, etc.
- cattle breeding
- mining and oil extraction
- dam construction

Deforestation has rendered several species of animals homeless. Many species of flora and fauna have been lost, and some are on the verge of extinction.

Cutting trees and destroying forests increases the amount of carbon dioxide in the atmosphere and it starts to accumulate there leading to global warming. It has also led to climate changes and several ecological imbalances like increasing temperatures, decreasing rainfall, etc. Cutting of trees results in soil erosion, and the soil along with its nutrients are lost. Continued erosion makes the land hard and infertile, leading to desertification; the land becomes unfit for the growth of any plants. When trees are cut down, excess runoff leads to decreased infiltration into the soil and depletion of ground water levels. The flow of water leads to natural calamities like floods in many areas. Cutting of trees decreases the amount of water vapour released through transpiration and there is a corresponding decrease in the amount of rainfall. Deforestation also affects the lives of the indigenous tribes of people.

2. The advantages of in-situ conservation are as follows:

- The natural habitat is maintained and the species can adapt to their habitats.
- The species can interact with each other.
- It costs less to set up and is easy to manage.
- The interests of the indigenous people are protected.

The advantages of ex-situ conservation are as follows:

- Several endangered animals can be bred through these conservation methods.
- Threatened species can also be bred and released into their natural environment.
- The decline of a species is prevented.
- This conservation technique is extremely useful for conducting scientific and research work.

3. There are two types of conservation, in-situ conservation which is within the habitat and ex-situ conservation which is outside the habitat.

Conservation of living organisms within the natural ecosystem where they occur is called in-situ conservation. This is carried out by protecting the natural habitat and maintaining endangered species in protected areas like national parks, wildlife sanctuaries, bird sanctuaries and biosphere reserves. Conservation of wildlife outside their habitat is called ex-situ conservation. Some of the strategies followed in this method include setting up botanical gardens, zoos and zoological parks, aquariums, captive breeding, conservation of genes, seed banks, seedling and tissue culture, etc.

4. In 1897, a group of animal lovers founded an organisation called 'Our Dumb Friends League' to care for working horses on the streets of London. Today it is known as the Blue Cross, and it is a registered animal welfare charity in the United Kingdom. Their aim is to make sure that every pet enjoys a healthy life in a happy home.

In 1959, in Chennai, Captain V. Sundaram started the Blue Cross of India. It has all the amenities like shelters, hospitals, ambulance services, animal birth control services, etc.

Some of the activities of the organization are as follows:

- Providing shelters and homes for unwanted pets.
  - Adoption and re-homing cats, dogs, small pets and horses.
  - Animal birth control.
- Maintaining animal hospitals and mobile animal dispensaries to treat sick and injured pets (especially owners who can't afford private veterinary treatment).
  - Providing ambulance services for sick and injured animals.
  - Educating the people on the responsibilities of animal ownership.
  - Spread animal right awareness.