Solution

Section A

1. **(a)** Corrosion
   Explanation: The copper articles turn green when kept for long due to corrosion in which metal is eaten up gradually by the action of air, moisture or a chemical (such as an acid) on their surface.

2. **(c)** Displacement reaction
   Explanation: Reactions in which atoms or ions move from one compound to others to form a new compound are known as Displacement reactions.
   $Fe\ (s) + CuSO_4\ (aq) \rightarrow Cu(s) + FeSO_4(aq)$
   Fe being more reactive is able to displace Cu from $CuSO_4$ solution.

3. **(b)** A, B, C and D
   Explanation: All the above salts contain water of crystallization and their chemical formulae are given below:
   Gypsum - $CaSO4.2H_2O$ - (2 molecules of water of crystallization)
   Epsom salt - $MgSO_4.7H_2O$ - (7 molecules of water of crystallization)
   Blue vitriol - $CuSO_4.5H_2O$ - (5 molecules of water of crystallization)
   Glauber's salt - $Na_2SO_4.10H_2O$ - (10 molecules of water of crystallization)

4. **(c)** Sodium ethoxide and hydrogen
   Explanation: This reaction can be shown by the following equations:
   $2Na + 2CH_3CH_2OH \longrightarrow 2CH_3CH_2ONa + H_2$
   Therefore, the products formed are sodium ethoxide and hydrogen.

5. **(d)** (i) and (iv)
   Explanation: Aluminium has good thermal conductivity and high melting point. These properties are useful in the making of utensils. The commonly used metals in making utensils are copper, steel (an alloy of iron) and aluminium.
   Copper and aluminium are the most preferred due to their conduction of heat.

6. **(d)** Magnesium is below calcium but above aluminium
   Explanation: Magnesium is below calcium but above aluminium

7. **(c)** 7 covalent bonds
   Explanation: Ethane - with the molecular formula C_2H_6 - has 7 covalent bonds. 1 covalent bond (C - C) exists between the two carbon atoms. 3 C - H covalent bonds are formed by 3 hydrogen atoms with each carbon atom.

8. **(c)** endosmosis rate will be more
   Explanation: Endosmosis rate will be more.

9. **(b)** two individuals of a species
   Explanation: species is the lowest level of classification and shows the high level of similarities among the organisms. so two individuals of a species have the maximum common characteristics.

10. **(a)** Fallopian tubes
    Explanation: The fertilization of ovum takes place in the ampulla of the fallopian tube.

11.

(d) DNA

Explanation: Heredity is the passing on of traits from parents to their offspring, either through asexual reproduction or sexual reproduction; the offspring cells or organisms acquire the genetic information of their parents.

Heritable traits are known to be passed from one generation to the next via DNA, a molecule that encodes genetic information.

12.

(d) Carbon dioxide

Explanation: Because of respiration, Carbon dioxide gets accumulated in tissues. Hence, blood leaving the tissues becomes richer in Carbon dioxide.

13.

(d) Current flowing through the solenoid is saturated.

Explanation: Current flowing through the solenoid is saturated.

14.

(d) 0.06A

Explanation: Both bulb receive the same current because they are connected in series. They will have different voltages.

15.

(b) Transfer of energy from one trophic level to other is associated with energy loss

Explanation: The quantum of available energy in a food chain successively gets decreased at each trophic level as a result of energy loss. This limits the number of trophic levels in a food chain.

16.

(c) various interlinked food chains in an ecosystem

Explanation: A food chain is a series of plants/animals which are interrelated in the form of an organism being eaten as food by the other. The Food web is constituted by various interlinked and interdependent food chains in a community. It is also called a consumer-resource system. The ecosystem consists of living organisms and their abiotic environment. Thus, the correct answer is 'Various interlinked food chains in a community.'

17.

(c) A is true but R is false.

Explanation: Silver reacts with sulphur present in the air and forms a layer of silver sulphide, therefore, silver articles get tarnished. Thus assertion is true, but reason is false.

18. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: DNA copying is necessary during reproduction because it leads to the transmission of characters from parents to offsprings and brings about variation.

19. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: Here while carrying out an experiment if a compass needle is placed near a wire carrying current then due to the effect of magnetism which is produced due to electric current produced in the wire the needle gets deflected. Which shows that the magnetism and electricity are interlinked. So, both assertion and reason are true and reason is the correct explanation of assertion.

20.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: Plastics are non-biodegradable. They cannot be decomposed by the action of microbes. Recycling them can manage them effectively.

Section B

21. Methanol (CH_3OH) is oxidised to methanal (HCHO) in the liver.

$2CH_3OH + O_2 \rightarrow 2HCHO + 2H_2O$

Methanal (HCHO) reacts rapidly with the components of body cells. It causes the protoplasm of the cells to coagulate. It also affects the optic nerve and causes blindness. Therefore, intake of small quantity of methanol can be lethal.

22. i. a. Testis - Anther
    b. Sperm - Pollen grains
    c. Ovary - Ovary
    d. Egg - Ovum

    ii. Flowers are the main organs of sexual reproduction. They contain the reproductive organs.

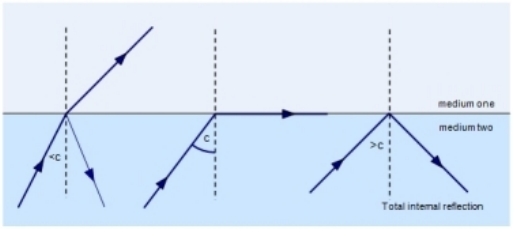
23. a. The separation of oxygenated and deoxygenated blood in mammals and birds is necessary to produce more energy in order to maintain their body temperature at different climatic Conditions.

    b. Amphibians can withstand some amounts of blood that is both oxygenated and deoxygenated because they don't require a lot of energy. They alter their body temperature.

OR

Respiration	Photosynthesis
1) Being an exothermic process energy is released.	1) Being an endothermic process, radiant energy of light is absorbed.
2) It is a catabolic process in which food substrates are broken down.	2) It is an anabolic process in which food substrates are synthesized.
3) It takes place in all living cells.	3) It is carried out only by the chlorophyll containing cells.
4) CO_2 is given out.	4) O_2 is released as a by product.
5) Chemical energy is converted into ATP and some energy is lost as heat.	5) Radiant energy of light is converted into chemical energy.

24. The following figure shows a ray of light incident obliquely. Every medium has a critical angle. When angle of incidence is more than critical angle, the ray of light comes back in the same medium. This phenomenon is called total internal reflection.



25. i. As uncle is supplying frogs from his village to laboratories so the number of frog population is decreasing. Frogs eat grasshoppers and mosquitoes. But as the number of frogs population is reduced so the population of grasshoppers and mosquitoes are increasing. So malaria is spread in the village by mosquitoes and grasshoppers are causing damage to the crops.

    ii. He must stop the supply of frogs to the laboratories as the reduced frog population is causing an imbalance in the food chain and proper ratio of frogs, grasshoppers and mosquitoes can not be maintained in the ecosystem.

OR

The maximum energy is available at T_1 trophic level and least at T_4. There is a progressive decline in the amount of energy available from producer to higher trophic levels, i.e. $T_1 > T_2 > T_3 > T_4$ (energy). This is because at each trophic level, a large portion of energy is utilised for the maintenance of organisms at that trophic level and some are lost as heat and only about 10 percent is available to next trophic level and stored as biomass.

26. i. Different colours of light bend through different angles with respect to the incident ray as they travel with different speeds while passing through a prism, this phenomenon is known as disperson of light.

ii. X = violet, this colour has minimum wavelength thus suffers maximum deviation, Y = red, as it has maximum wavelength and thus least deviated.

Section C

27. (i) As the metal 'M' forms oxide M_2O_3 it is trivalent. Out of the metals listed, only Fe and Al are trivalent.
(ii) M_2O_3 is not affected by water, so 'M' can be out of Fe or Al.
(iii) Fe and Al both corrode easily.
(iv) Out of Al and Fe, only Fe can form divalent chloride, so the element 'M' is Fe.

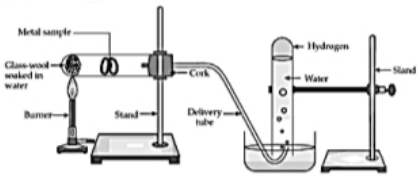
28. i. Formation of magnesium chloride - magnesium is a metal and chlorine is a non-metal. The magnesium atom loses 2 electrons to attain a stable configuration which results in the formation of magnesium cation Mg^{2+}.
Similarly, the chlorine atom gains an electron to complete its octet and results in the formation of chloride anion Cl^-.
When magnesium reacts with chlorine, two electrons lost by magnesium atoms are gained by two chlorine atoms. Mg^{2+} and Cl^- being oppositely charged, attract each other and are held by strong electrostatic forces of attraction to exist as $MgCl_2$.

$\underset{2,8,2}{Mg} \rightarrow \underset{2,8}{Mg^{2+}} + 2e^-$
(Magnesium cation)

$\underset{2,8,7}{Cl} \rightarrow \underset{2,8,8}{Cl^-}$
(Chloride anion)

ii. Due to the strong force of attraction between the metal with a positive charge and metal with a negative charge, ionic compounds are solid.

iii. **Reaction with steam:** Metals like iron, zinc and aluminum react with steam to form corresponding hydroxide and hydrogen gas.



OR

i. a. Ionic compounds have strong force of attraction between the oppositely charged ions (e.g., Na^+ and Cl^-), so they are solids. Covalent compounds have weak force of attraction between their molecules, so they are usually liquids or gases.
b. Ionic compounds are soluble in water but covalent compounds are insoluble in water.
c. Ionic compounds conduct electricity when dissolved in water or when melted because they contain ions (charged particles). But, covalent compounds like glucose do not conduct electricity because they do not contain ions.

ii. a. The metal M which is in the middle of the reactivity series (such as iron, zinc, lead, copper, etc.) is moderately reactive. So, for obtaining such metals from their compounds, their sulphides and carbonates (in which they are present in nature) are first converted into their oxides by the process of roasting and calcination respectively. For example,

$\underset{\substack{Zinc\ Sulphide\\(Sulphide ore)}}{2ZnS\,(s)} + 3O_2\,(g) \xrightarrow{Heat} 2ZnO\,(s) + 2SO_2\,(g)$

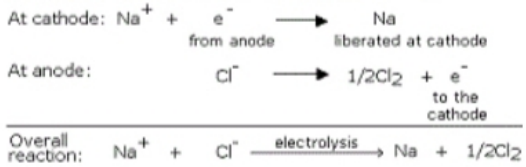
$\underset{\substack{Zinc\ Carbonate\\(Carbonate\ are)}}{ZnCO_3\,(s)} \xrightarrow{Heat} ZnO\,(s) + CO_2\,(g)$

The metal oxide (MO) are then reduced to the corresponding metals by using suitable reducing agents such as carbon. For example, zinc metal from its oxide is obtained as follow:

$\underset{Zinc\ oxide}{ZnO(s)} + C(s) \rightarrow \underset{Zinc}{Zn(s)} + CO(g)$

b. The metal N which is high up in the reactivity series (such as sodium, magnesium, calcium, aluminium, etc.), is very reactive and cannot be obtained from its compound by heating with carbon.
Therefore, such metals are obtained by electrolytic reduction of their molten salt. For example, sodium is obtained by the

electrolysis of molten sodium chloride ($NaCl$).



29. The deoxygenated blood is collected from the body tissues through the veins which further combine to form vena cava. This vena cava pours deoxygenated blood collected from the body tissues into the right auricle of the heart. From the right auricle, it goes to the right ventricle and from here the blood is pumped into the pulmonary artery which takes the deoxygenated blood from the heart to the lungs. In the alveoli of the lungs, the blood is oxygenated. This oxygenated blood is pumped into the pulmonary veins which pour the blood into the left auricle. From here the oxygenated blood is poured into the left ventricle. The left ventricle pushes the blood into the aorta which pumps the oxygenated blood into the body tissues and supplies oxygen through the tissues for various body functions.

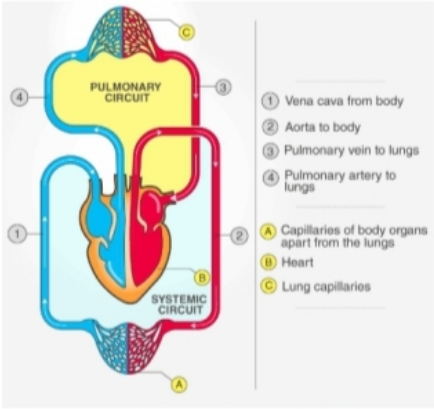
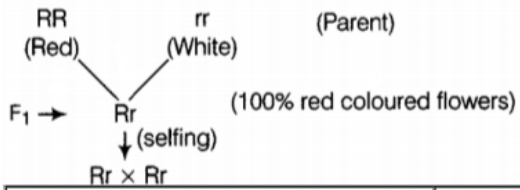


Figure: The double circulation of blood

30. When two plants, A with white flowers and B with red flowers were crossed,
In F_1 generation all the plants have red coloured flowers and in F_2 generation the ratio of red : white is 3 : 1.

The dominant trait is red colour in flowers.
The recessive trait is white colour in flowers.

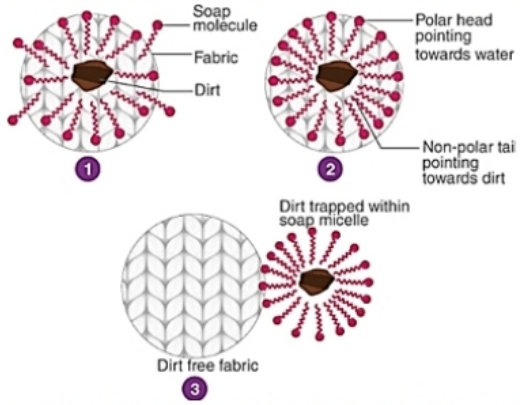


Gametes	**R**	**r**
R	RR(red)	Rr(red)
r	Rr(red)	rr(red)

31. The virtual image formed by a concave mirror is always magnified whereas the virtual image formed by a convex mirror is diminished.
32. 1kwh = 1000 watt × 3600 seconds
= 3.6×10^6 wattsecond
= 3.6×10^6 joule (J)
The SI unit of energy is joules (J).
33. i. Zero, current flows due to potential difference and not due to potentials.
ii. Energy consumed (in kWh) = power (in kW) × time (h) = 2.2 kW × 3h = 6.6 kWh
Power = 2.2 kW = 2.2 × 1,000 W = 2,200 W
But Power = Voltage × Current
2,200 = 220 × I
$I = \frac{2200}{220}$ = 10 A

Section D

34. i. Soaps are molecules has two ends have differing properties, one is hydrophilic (interacts with water), while the other end is hydrophobic (interacts with hydrocarbons). When soap is at the surface of water, the hydrophobic 'tail' of soap will not be soluble in water and the soap will align along the surface of water with the ionic end in water and the hydrocarbon 'tail' protruding out of water. Inside water, these molecules keeps the hydrocarbon portion out of the water. Thus, clusters of molecules in which the hydrophobic tails are in the interior of the cluster and the ionic ends are on the surface of the cluster. This formation is called a micelle. Soap in the form of a micelle is able to clean, since the oily dirt will be collected in the centre of the micelle. The micelles stay in solution as a colloid and will not come together because of ion-ion repulsion. Thus, the dirt suspended in the micelles is also easily rinsed away. The soap micelles are large enough to scatter light.



ii. Detergents are sodium salts of sulphonic acids or ammonium salts with chlorides or bromide ions etc. Detergents have long hydrocarbon chains. The charged ends of these compounds do not form insoluble precipitates with the calcium and magnesium ions in hard water but soap reacts with calcium and magnesium ions present in the hard water to form insoluble substance called scum. Thus, detergents are better cleansing agents than soaps, they remain effective even in hard water.

OR

a. Isomers are those compounds which have the same molecular formula but different structural formula

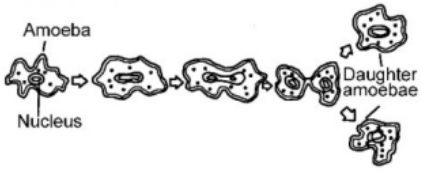
b.
- Propanal- CH_3CH_2CHO
- Propanone- CH_3COCH_3

Above are the name of these compounds and their structural formula.

c. i. $CH_3CH_2OH \xrightarrow[\text{Conc. } H_2SO_4]{443\ K} H_2C = CH_2 + H_2O$

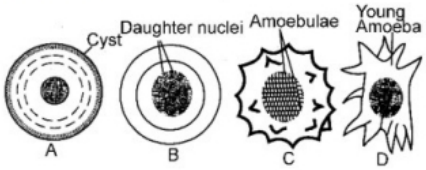
ii. $CH_3CH_2OH \xrightarrow[\text{Heat}]{\text{Alkaline } KMnO_4} CH_3CH_2COOH + H_2O$

35. Binary fission in Amoeba. It is normal method of reproduction in Amoeba. It occurs under favourable conditions. The animal grows until it attains the maximum size and then divides by binary fission in every three or four days. The fission is completed in 15 to 20 minutes.



Multiple fusion in Amoeba

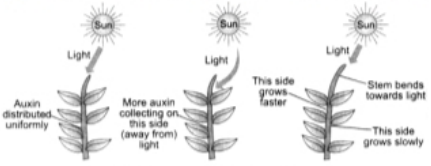
Multiple fission inside the cyst has been described but not established. It has been suggested that sometimes inside the cyst, the nucleus divides and surrounds itself with cytoplasm to form several small amoebulae. At the return of favourable conditions or on finding a favourable substrate, the cyst absorbs water and its walls burst. The amoebulae escape and soon each one grows into new amoeba.



OR

The directional movement of a plant part/plant in response to light is called phototropism. The shoot responds by bending towards light while roots respond by bending away from the light. We know that the plant stem responds to light and bends towards it due to the action of auxin hormone. When sunlight comes from above, then the auxin hormone present at the tip of the stem spreads uniformly down the stem. Due to the equal presence of auxin, both the sides of the stem grow straight and with same rapidity.This is because auxin hormone moves away from the light.

Thus, more auxin hormone is present in the left side of stem as compared to the right. The left side of stem, grows faster than its right side and therefore, the stem bends towards the right side (direction of light).



Experiment to show the effect of auxin on the growth of a plant in response to light (Phototropism)

The effect of auxin on the growth of a root is exactly opposite to that on a stem. Auxin hormone increases the rate of growth in stem but it decreases the rate of growth in a root. The side of root away from light will have all the auxin concentrated in it. Due to this, the side of root which is away from light will grow slower than the other side and make the root bends away from light.

36. Given: Height of object (h_o) = 4 cm

Object distance (u) = -25 cm(-ve as it is in front of mirror)

Focal length (f) = -15 cm

i. Applying mirror formula and substituting the values,

$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$\frac{1}{v} = \frac{1}{-15} - \frac{1}{-25}$

$\frac{1}{v} = \frac{-5+3}{75}$

v = $\frac{-75}{2}$ = -37.5 cm

The negative sign indicates that the image is in front of the mirror.

Therefore, the screen must be placed in front of the mirror at a distance of 37.5 cm.

ii. Applying the magnification formula and substituting the values,

m = $\frac{-v}{u} = \frac{h_i}{h_o}$

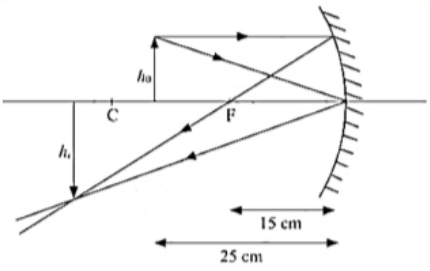
$\frac{-\left(\frac{-75}{2}\right)}{-25} = \frac{h_i}{4}$

h_i = $\frac{-75}{2\times25} \times 4$

h_i = -6 cm

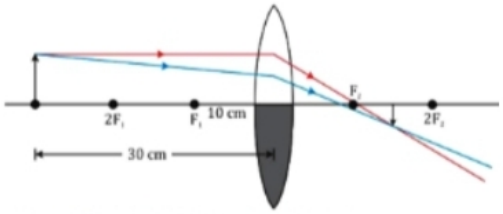
The image will be 6cm high and it will be inverted.

iii. The ray diagram showing the formation of image in this case is,



OR

When a convex lens is covered half with black paper as shown in diagram, then image of full object will formed , but it will be of less intensity and brightness.



As h_0 = 4 cm, f = 20 cm and u = - 15 cm

By lens formula,

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{20} + \frac{1}{(-15)} = \frac{15-20}{300} = \frac{-5}{300}$

$\therefore \ v = -60cm$

As, magnification,

$m = \frac{h_i}{h_0} = \frac{v}{u}$

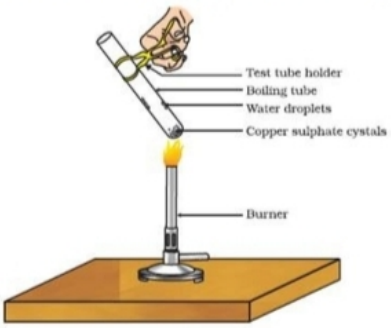
$\Rightarrow h_i = h_0 \times \frac{v}{u} = 4 \times \frac{-60}{-15} = 16 \ cm$

Image formed is virtual, erect and magnified.

Section E

37. **Read the text carefully and answer the questions:**

Copper sulphate crystal contains water of crystallisation when the crystal is heated the water is removed and salt turns white. The crystal can be moistened again with water. The water of crystallisation is the fixed number of water molecules present in 1 formula unit of copper sulphate. On heating gypsum at 373K, it loses water molecules and became calcium sulphate hemihydrate.



(i) If the crystal is moistened with water, then the blue colour of the crystal reappears.

(ii) The commercial name of calcium sulphate hemihydrate is Plaster of Paris.

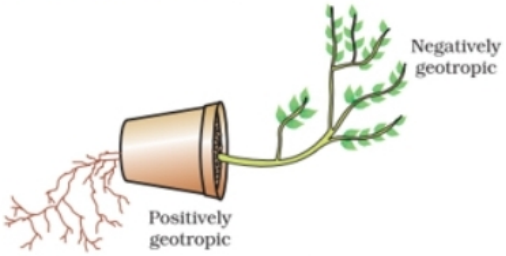
OR

Five water molecules are present in one formula unit of copper sulphate.

38. **Read the text carefully and answer the questions:**

Environmental triggers such as light, or gravity will change the directions that plant parts grow in. These directional, or tropic, movements can be either towards the stimulus or away from it. So, in two different kinds of phototropic movement, shoots respond by bending towards light while roots respond by bending away from it. How does this help the plant? Plants show tropism in response to other stimuli as well. The roots of a plant always grow downwards while the shoots usually grow upwards and away from the earth. This upward and downward growth of shoots and roots, respectively, in response to the pull of earth or gravity, is, obviously, geotropism. If 'hydro' means water and 'chemo' refers to chemicals, what would 'hydrotropism' and 'chemotropism' mean? Can we think of examples of these kinds of directional growth movements? One example of chemotropism is the growth of pollen tubes towards ovules, about which we will learn more when we examine the reproductive

processes of living organisms.



(i) In plants, negative phototropism occurs in roots.

(ii) Phototropism in shoots is attributed due to auxin in plants.

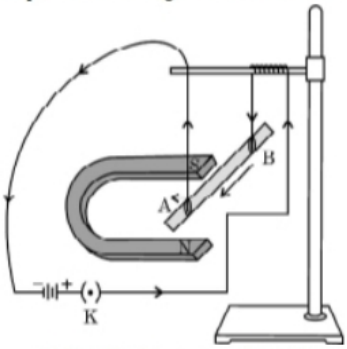
(iii)Tendrils exhibit/ twining of tendrils show thigmotropism movement.

OR

Positive phototropic movement.

39. **Read the text carefully and answer the questions:**

A student was asked to perform an experiment to study the force on a current carrying conductor in a magnetic field. He took a small aluminum rod AB, a strong horse shoe magnet, some connecting wires, a battery and a switch and connected them as shown. He observed that on passing current, the rod gets displaced. On reversing the direction of current, the direction of displacement also gets reversed. On the basis of your understanding of this phenomenon, answer the following questions :



(i) The displacement of the conductor is maximum when the direction of the current is at right angles to the direction of the magnetic field.

(ii) The rule that determines the direction of the force on the conductor AB is Fleming's left-hand rule.

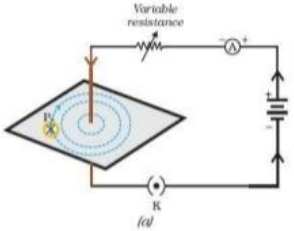
According to Fleming's left-hand rule, stretch the thumb, forefinger and middle finger of your left hand such that they are mutually perpendicular.

If the first finger points in the direction of the magnetic field and the second finger in the direction of current, then the thumb will point in the direction of motion or force.

(iii) i. According to Fleming's left-hand rule, the rod will get displaced upwards.

ii. Devices that use current-carrying conductors and magnetic fields are electric motors, electric generators, loudspeakers, microphones, etc.

OR



(a)


(b)