SCIENCE
CBSE Class-10 (2025)

| Series-1GEFH | QP Code-31/1/1 | Set-I |

Section-A

Time allowed: 3 hours   **Maximum Marks: 80**

General Instructions:

Read the following instructions very carefully and strictly follow them:

(i) This question paper comprises 39 questions. **All** questions are compulsory.

(ii) This question paper is divided into **five** sections **- A, B, C, D and E.**

(iii) **Section A** - Question Nos. 1 to 20 are multiple choice questions. Each question carries 1 mark.

(iv) **Section B** - Question Nos. 21 to 26 are very short answer type questions. Each question carries 2 marks. Answer to these questions should be in the range of 30 to 50 words.

(v) **Section C** - Question Nos. 27 to 33 are short answer type questions. Each question carries 3 marks. Answer to these questions should be in the range of 50 to 80 words.

(vi) **Section D** - Question Nos. 34 to 36 are long answer type questions. Each question carries 5 marks. Answer to these questions should be in the range of 80 to 120 words.

(vii) **Section E** - Question Nos. 37 to 39 are of 3 source-based/case-based units of assessment carrying 4 marks each with sub-parts.

(viii) There is no overall choice. However, an internal choice has been provided in some sections. Only one of the alternatives has to be attempted in such questions.

Section A

Select and write the most appropriate option out of the four options given for each of the questions 1-20. There is no negative mark for the incorrect response.   **(1x20=20)**

1. *Electrolysis of water is a decomposition reaction. The mass ratio ($M_H : M_O$) of hydrogen and oxygen gases liberated at the electrodes during electrolysis of water is :*
   (A) 8 : 1   *(B) 2 : 1*
   (C) 1 : 2   *(D) 1 : 8*

Solution: (D) 1:8

Explanation:

Electrolysis of water breaks water (H_2O) into hydrogen (H_2) and oxygen (O_2) gases. The balanced chemical equation is:

$$2H_2O \ \rightarrow \ 2H_2 + O_2$$
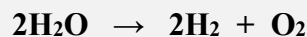
This tells us that two moles of water (**H_2O**) breaks into two moles of Hydrogen (H_2) and two moles of Oxygen (O_2).

Now,

Molar mass of Hydrogen(H_2) = 2gm/mole = 2*2 = 4gm

Molar mass of Oxygen (O_2) = 16 gm/mole = 16*2 = 32gm

Hence, mass of hydrogen : mass of oxygen = 4/32 = 1/8

2. The products formed when Aluminium and Magnesium are burnt in the presence of air respectively are:
(A) Al_3O_4 and MgO_2   *(B) Al_2O_3 and MgO*
(C) Al_3O_4 and MgO   *(D) Al_2O_3 and MgO_2*

Solution: (B) Al_2O_3 and MgO

Explanation: When Aluminium (Al) and Magnesium (Mg) are burnt in the presence of air (oxygen), they form their respective oxides as shown below:

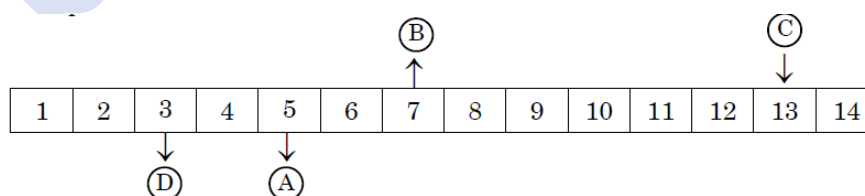Aluminium reacts with oxygen to form Aluminium oxide (Al_2O_3)**:**

$$4Al + 3O_2 \ \rightarrow \ 2Al_2O_3$$

Magnesium reacts with oxygen to form Magnesium oxide (MgO)**:**

$$2Mg + O2 \ \rightarrow \ 2MgO$$

Thus, the product formed are Al_2O_3 and MgO.

3. The following table shows the pH values of four solutions A, B, C and D on a pH scale:

The solutions A, B, C and D respectively are of a:
(A) Strong acid, weak acid, neutral, strong base
(B) Weak acid, neutral, weak base, strong base
(C) Weak acid, neutral, strong base, weak base
(D) Weak acid, neutral, strong base, strong acid

Solution: (D) Weak acid, neutral, strong base, strong acid

Explanation: The general rule for determining acid and bases through pH scale is:
- ➤ **If pH value of the solution is less than 7 →** the solution is acidic
  - ✓ **0–3**: Strong acid
  - ✓ **4–6**: Weak acid
- ➤ **If pH value of the solution is equal to 7 →** the solution is neutral (i.e. water)

- ➤ **If pH value of the solution is more than 7 →** the solution is basic
  - ✓ **8-10**: weak base
  - ✓ **11-14**: strong acid

4. Consider the following reactions:

(i) Dilute hydrochloric acid reacts with sodium hydroxide.

(ii) Magnesium oxide reacts with dilute hydrochloric acid.

(iii) Carbon dioxide reacts with sodium hydroxide.

It is found that in each case:

(A) Salt and water is formed.

(B) Neutral salts are formed.

(C) Hydrogen gas is formed.

(D) Acidic salts are formed.

Solution: (A) Salt and water is formed.

Explanation:

Case 1: Dilute hydrochloric acid reacts with sodium hydroxide.

This is an acid-base neutralization reaction.
$$HCl + NaOH \rightarrow NaCl + H_2O$$
Salt (sodium chloride) and water are formed.

Case 2: Magnesium oxide reacts with dilute hydrochloric acid.

This is a reaction between a basic oxide and an acid.
$$MgO + 2HCl \rightarrow MgCl_2 + H_2O$$
Salt (magnesium chloride) and water are formed.

Case 3: Carbon dioxide reacts with sodium hydroxide.

This is a reaction between an acidic oxide (carbon dioxide) and a base.
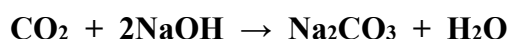
$$CO_2 + 2NaOH \rightarrow Na_2CO_3 + H_2O$$
Salt (sodium carbonate) and water are formed.

Hence, in all three reactions, salt and water are formed.

*5. Reaction between two elements A and B, forms a compound C. A loses electrons and B gains electrons. Which one of the following properties will **not** be shown by compound C?*

Solution: (C) It has weak electrostatic forces of attraction between its oppositely charged ions.

Explanation: The reaction between elements A and B forms compound C, where A loses electrons and B gains electrons. This indicates that A is a metal (forms a positive ion) and B is a non-metal (forms a negative ion) and the resulting in compound C being an ionic compound. The general properties of ionic compound are:

(i)   **Physical nature:** Ionic compounds are solids and are somewhat hard because of the strong force of attraction between the positive and negative ions.

(ii)   **Melting and Boiling points**: Ionic compounds have high melting and boiling points. This is because a considerable amount of energy is required to break the strong inter-ionic attraction.

(iii)   **Solubility:** Electrovalent compounds are generally soluble in water and insoluble in solvents such as kerosene, petrol, etc.

(iv)   **Conduction of Electricity:** A solution of an ionic compound in water contains ions, which move to the opposite electrodes when electricity is passed through the solution. Ionic compounds in the solid state do not conduct electricity because movement of ions in the solid is not possible due to their rigid structure. But ionic compounds conduct electricity in the molten state.

6. The metals obtained from their molten chlorides by the process of electrolytic reduction are:
(A) Gold and silver
(B) Calcium and magnesium
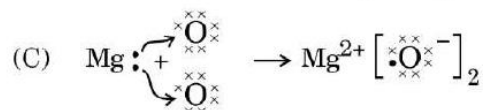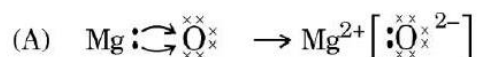*(C) Aluminium and silver*
(D) Sodium and iron

Solution: (B) Calcium and magnesium
The process of electrolytic reduction is used to extract highly reactive metals (such as alkali and alkaline earth metals) from their molten chlorides or oxides because these metals cannot be reduced by conventional reducing agents like carbon.
Metals like **calcium** and **magnesium** are highly **reactive** and are extracted by **electrolytic reduction** of their **molten chlorides** (e.g., **$CaCl_2$, $MgCl_2$**) because:
- They are **alkaline earth metals** with high electropositive character.
- They **cannot be reduced** by chemical reducing agents due to their high reactivity.
- Electrolysis is done on **molten salts** (not aqueous) to avoid reaction with water.

**7.** The formation of magnesium oxide is correctly shown in option:

(A) $Mg \overset{\times\times}{\overset{}{O}}{\times} \rightarrow Mg^{2+}\left[\overset{\times\times}{\underset{\times\times}{:O:}}\right]^{2-}$

(B) $Mg\cdot \rightarrow \overset{\times\times}{O}{\times} \rightarrow Mg^{+}\left[\overset{\times\times}{:O:}\right]^{-}$

(C) $Mg: + \begin{matrix}\overset{\times\times}{O}{\times} \\ \overset{\times\times}{O}{\times}\end{matrix} \rightarrow Mg^{2+}\left[:O:\right]^{-}_{2}$

(D) $2Mg \times \rightarrow \overset{\cdot\cdot}{O}: \rightarrow \left[Mg^{2+}\right]_{2}\left[:\overset{\cdot\cdot}{O}:\right]^{2-}$

Solution: (A)
Explanation:

Element	Symbol	Atomic No.	Electronic Configuration
Magnesium	Mg	12	2,8,2
Oxygen	O	8	2,6

This tells us that magnesium 2 valence electrons and oxygen has 6 valence electrons. Oxygen needs 2 more electrons to complete its octet. So, magnesium will loose its two electrons and oxygen will gain 2 electrons.
The lewis dot structure of MgO is shown below:

$Mg: + \quad :O: \longrightarrow [Mg^{2+}][:O:]^{2-}$
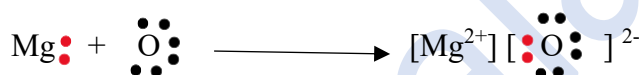
8. Secretion of less saliva in mouth will effect the conversion of :
(A) proteins into amino acids
(B) fats into fatty acids and glycerol
(C) starch into simple sugars
(D) sugars into alcohol

Solution: (C) starch into simple sugars
Explanation:
Saliva in the mouth contains the enzyme amylase, which is responsible for breaking down starch into maltose (a simple sugar). If less saliva is secreted, the digestion of starch in the mouth is reduced, and the conversion of starch into simple sugars is affected.

9. The plant hormone whose concentration stimulates the cells to grow longer on the side of the shoot which is away from light is:
(A) Cytokinins
(B) Gibberellins
(C) Adrenaline
(D) Auxins
Solution: (D) Auxins
Auxins are plant hormones that play a crucial role in cell elongation, particularly in stems. When light shines on one side of a plant, auxins migrate to the shaded side. This increased concentration of auxins on the shaded side stimulates the cells there to grow longer, causing the plant to bend towards the light source.

10. *The correct/true statement(s) for a bisexual flower is/are :*
(i) They possess both stamen and pistil.
(ii) They possess either stamen or pistil.
(iii) They exhibit either self-pollination or cross-pollination.
(iv) They cannot produce fruits on their own.
  (A) (i) only   *(B) (iv) only*
  (C) (i) and (iii)   *(D) (i) and (iv)*

Solution: (C) (i) and (iii)
Explanation:
Statement- (i) They possess both stamen and pistil.
This statement is true. A bisexual flower contains both male (stamen) and female (pistil) reproductive organs.
Statement-(ii) They possess either stamen or pistil.
This statement is incorrect, as bisexual flowers have both stamen and pistil.
Statement - (iii) They exhibit either self-pollination or cross-pollination.
This statement is correct. Bisexual flowers have both reproductive parts, they can undergo self-pollination or cross-pollination.
Statement -(iv) They cannot produce fruits on their own.
This statement is incorrect. Bisexual flowers can produce fruits on their own either through self-pollination or cross-pollination.

11. *If pea plants with round and green seeds (RRyy) are crossed with pea plants having wrinkled and yellow seeds (rrYY), the seeds developed by*
the plants of F1 generation will be :
(A) 50% round and green   *(B) 75% wrinkled and green*
(C) 100% round and yellow   *(D) 75% wrinkled and yellow*
Solution: (C) 100% round and yellow
Explanation:
This is a dihybrid cross involving two traits:
- Seed shape: Round (R, dominant) vs. Wrinkled (r, recessive)
- Seed color: Yellow (Y, dominant) vs. Green (y, recessive)

Parental Cross:
- Parent 1 (RRyy): Round & green (homozygous dominant for shape, homozygous recessive for color)
- Parent 2 (rrYY): Wrinkled & yellow (homozygous recessive for shape, homozygous dominant for color)

F1 Generation (First Filial Generation):
- The gametes from parents are:
  - RRyy → Ry
  - rrYY → rY
- When crossed (Ry × rY), all F1 offspring will be RrYy (heterozygous for both traits).
Phenotype of F1:
- Round (R) is dominant over wrinkled (r) → All seeds will be round.
- Yellow (Y) is dominant over green (y) → All seeds will be yellow.
Thus, 100% of F1 seeds will be round and yellow.

12. The breakdown of glucose has taken the following pathway:

$$Glucose \xrightarrow{(a)} Pyruvate + Energy \xrightarrow{(b)} Lactic\ acid + Energy$$
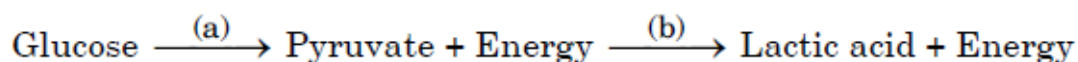
The sites 'a' and 'b' respectively are:
(A) Mitochondria and Oxygen deficient muscle cells
(B) Cytoplasm and Oxygen rich muscle cells
(C) Cytoplasm and Yeast cells
(D) Cytoplasm and Oxygen deficient muscle cells
Solution: (D) Cytoplasm and Oxygen deficient muscle cells
Explanation:
The breakdown of glucose occurs in two main stages. The first stage, glycolysis, takes place in the cytoplasm, where one molecule of glucose is converted into pyruvate, producing a small amount of energy in the form of ATP. The second stage occurs under anaerobic conditions (in the absence of oxygen), particularly in muscle cells, where pyruvate is converted into lactic acid, releasing additional energy.

13. *Mirror 'X' is used to concentrate sunlight in solar furnace and Mirror 'Y' is fitted on the side of the vehicle to see the traffic behind the driver. Which of the following statements are true for the two mirrors?*
(i) The image formed by mirror 'X' is real, diminished and at its focus.
(ii) The image formed by mirror 'Y' is virtual, diminished and erect.
(iii) The image formed by mirror 'X' is virtual, diminished and erect.
(iv) The image formed by mirror 'Y' is real, diminished and at its focus.
   (A) (i) and (ii)   *(B) (ii) and (iii)*
   (C) (iii) and (iv)   *(D) (i) and (iv)*

Solution: (A) (i) and (ii)

Explanation:
Mirror X (concave mirror):
In a solar furnace, a concave mirror is used to concentrate sunlight. It forms a real, diminished, and at its focus image when the object is placed between the mirror and its focal point. Statement (i) is true.
Mirror Y (convex mirror):
In a vehicle rear view mirror, a convex mirror is used to provide a wider field of view. It forms a virtual, diminished, and erect image. Statement (ii) is true.

14. *An old person is suffering from an eye defect caused by weakening of ciliary muscles and diminishing flexibility of the eye lens. If the defect of vision is 'a' which can be corrected by lens 'b', then 'a' and 'b' respectively are:*
(A) hypermetropia and convex lens
(B) presbyopia and bifocal lens
(C) myopia and concave lens
(D) myopia and bifocal lens

Solution: (B) presbyopia and bifocal lens

Explanation:

The condition described for the old person is — weakening of ciliary muscles and reduced flexibility of the eye lens which is the characteristic of Presbyopia. Presbyopia is commonly corrected by using bifocal lenses.

15. Which of the following groups do not constitute a food chain ?
(i) Wolf, rabbit, grass, lion
(ii) Plankton, man, grasshopper, fish
(iii) Hawk, grass, snake, grasshopper, frog
(iv) Grass, snake, wolf, tiger

   (A) (i) and (iv)   *(B) (i) and (iii)*
   (C) (ii) and (iii)   *(D) (ii) and (iv)*

Solution: (D) (ii) and (iv)

Explanation:

(i) Wolf, rabbit, grass, lion

Grass $\longrightarrow$ Rabbit $\longrightarrow$ Wolf $\longrightarrow$ Lion (Correct order)

(ii) Plankton, man, grasshopper, fish

 Plankton $\longrightarrow$ fish $\longrightarrow$ man; here grasshopper does not fit. (incorrect order).

(iii) Hawk, grass, snake, grasshopper, frog

Grass $\longrightarrow$ grasshopper $\longrightarrow$ frog $\longrightarrow$ snake $\longrightarrow$ hawk (Correct order)

(iv) Grass, snake, wolf, tiger

Grass $\longrightarrow$? $\longrightarrow$ snake $\longrightarrow$? $\longrightarrow$ wolf/tiger (incorrect order)

16. The percentage of solar energy which is not converted into food energy by the leaves of green plants in a terrestrial ecosystem is about:
   (A) 1%   *(B) 10%*
   (C) 90%   *(D) 99%*

Solution: (D) 99%

Explanation:

In a terrestrial ecosystem, green plants (producers) capture only about 1% of the total solar energy that reaches them through photosynthesis. This means that approximately 99% of solar energy is not converted into food energy.

For Questions number 17 to 20, two statements are given — one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.
(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
*(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is **not** the correct explanation of Assertion (A).*
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false, but Reason (R) is true.

17. *Assertion (A) : Decomposition reactions are generally endothermic reactions.*
Reason (R) : Decomposition of organic matter into compost is an exothermic process.

Solution: (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is *not* the correct explanation of Assertion (A).
Explanation:
Decomposition reactions involve breaking down a compound into simpler substances. Breaking chemical bonds typically requires energy, which is why most decomposition reactions are endothermic (absorb heat). However, the decomposition of organic matter during composting releases heat due to microbial activity — so it's a biological exothermic process. While most decomposition reactions are endothermic, the decomposition of organic matter (composting) is an exception because it is exothermic due to microbial metabolism.
Hence, Reason (R) does not explain Assertion (A); instead, it provides an exception to the statement in (A).

18. *Assertion (A): A human child bears all the basic features of human beings.*
Reason (R): It looks exactly like its parents, showing very little variations.

Solution: (C) Assertion (A) is true, but Reason (R) is false.
Explanation:
The Assertion (A): A human child bears all the basic features of human beings is true because a human child inherits genetic traits (DNA) from its parents and belongs to the species *Homo sapiens*. Basic human features like limbs, eyes etc. are present in every healthy human child.

The Reason (R): It looks exactly like its parents, showing very little variations is false because while a child inherits traits from parents, it does not look exactly like them due to genetic recombination (mixing of parental genes during meiosis).
Hence, Assertion (A) is correct, but Reason (R) is factually wrong.

19. *Assertion (A) : No two magnetic field lines are found to cross each other.*
Reason (R) : The compass needle cannot point towards two directions at the point of intersection of two magnetic field lines.

Solution: (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
Explanation:
The Assertion (A): No two magnetic field lines are found to cross each other is true because Magnetic field lines never intersect. This is a fundamental property of magnetic fields.

Reason (R): The compass needle cannot point towards two directions at the point of intersection of two magnetic field lines is also true If two magnetic field lines intersected, it would mean that at the point of intersection, a compass needle would point in two different directions simultaneously which is physically not possible because a compass needle can only point in one direction at a time.

20. *Assertion (A) : The amount of ozone in the atmosphere began to drop sharply in the 1980s.*
Reason (R) : The oxygen atoms combine with molecular oxygen to form ozone.

Solution: (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is *not* the correct explanation of Assertion (A).

Explanation:

The assertion, "The amount of ozone in the atmosphere began to drop sharply in the 1980s," is true.

The reason, "Oxygen atoms combine with molecular oxygen to form ozone," is also true but it does not explain the sharp drop in ozone levels in the 1980s as discussed below:

- Ozone (O_3) forms naturally when UV radiation splits O_2 into free oxygen atoms (O), which then react with another O_2 molecule:

$$O_2 + UV \rightarrow 2O$$
$$O + O_2 \rightarrow O_3$$

However, this natural ozone formation process does not explain why ozone levels dropped sharply in the 1980s. The real reason was human-made CFCs breaking down ozone
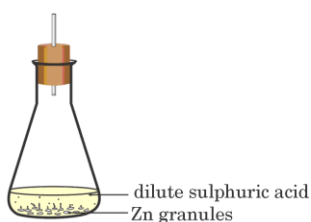
$$(Cl + O_3 \rightarrow ClO + O_2)$$

Hence, Reason (R) is scientifically correct but does not justify Assertion (A).

SECTION B

Questions no. 21 to 26 are Very Short Answer Type questions.

21. *A student performs the following experiment in his school laboratory.*   *2*

dilute sulphuric acid
Zn granules

List two observations to justify that in this experiment a chemical change has taken place.

Solution: 21

In the experiment shown in the image, zinc granules are reacting with dilute sulphuric acid which is a chemical change. Two observations that justify this are:

1. **Evolution of gas**: When zinc reacts with dilute sulphuric acid, the zinc displaces hydrogen from sulphuric acid forming zinc sulphate **($ZnSO_4$)** and hydrogen gas **(H_2).** This can be observed as a bubbling or effervescence around the zinc granules. The evolution of a gas is a key indicator of a chemical change.
2. **Increase in temperature (Exothermic reaction)** – This reaction releases heat energy making it an exothermic reaction. Heat is a sign that energy changes are happening, which is typical in chemical reactions.

$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow + Energy$$

22. *Draw labelled diagrams to show different stages of budding in Hydra.* **2**

Solution: 22 (Source of the image – NCERT Books)

Creating a bud   Beginning to cleave   New hydra formed
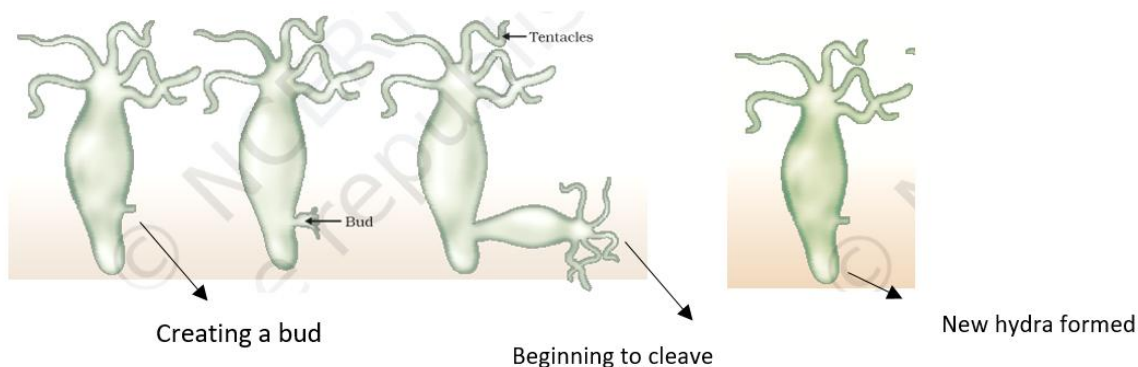
(Source of the image – NCERT Books)

23. *(a) Besides minimising the loss of blood, why is it essential to plug any leak in a blood vessel? Name the component of blood which helps in this process and state how this component perform this function.* **2**

OR

(b) (i) The transport system in plants is relatively slower than in animals. Give reasons.
(ii) State the role of phloem in the transport of materials in plants. **2**

Solution: 23(a)

Besides minimizing the loss of blood, it is necessary to plug any leak in a blood vessel to prevent the entry of harmful microbes or pathogens into the bloodstream and maintaining proper blood pressure.

Platelets (thrombocytes) helps in plugging the leak in a blood vessel. When a blood vessel is injured, platelets gather at the site of injury. They stick to the damaged area and release chemicals that trigger a complex series of reactions called the clotting cascade. This leads to the formation of a fibrin mesh (fibrinogen) that traps blood cells and forms a clot. The clot seals the wound, preventing further blood loss and entry of pathogens.

OR

Solution: 23(b)(i)

The transport system in plants is relatively slower than in animals mainly because plants are largely stationary and have lower metabolic rates. As a result, they do not require rapid oxygen delivery or energy supply for movement. Moreover, plants lack a dedicated pumping organ like the heart. Instead, the movement of water, minerals, and nutrients occurs through passive processes such as diffusion, osmosis, and capillary action.

Solution: 23(b)(ii)

Phloem is responsible for the translocation of organic nutrients, primarily sugars like sucrose, and other essential substances from the sites of production (mainly leaves) to the sites of

consumption or storage (such as roots, stems, fruits, and seeds). This transport occurs in both upward and downward directions, making it bidirectional.

24. *An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm. Use lens formula to find the position of the image formed in this case.*　　*2*

Solution: 24

Given,
Focal length of the concave lens (f) = - 30cm (for concave lens, the focal length is negative)
Object distance (u) = -60cm (object is on the left side of the lens)

Applying the lens formula,

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

$$\frac{1}{-30} = \frac{1}{v} - \frac{1}{-60}$$

$$\frac{1}{v} = \frac{1}{-30} - \frac{1}{60}$$

$$\frac{1}{v} = \frac{-2-1}{60}$$

$$\frac{1}{v} = \frac{-3}{60}$$

$$\mathcal{V} = -20 \text{ cm}$$

The image is located at a distance of 20 cm from the lens on the object side. The negative sign indicates that the image is virtual, diminished and erect and formed on the same side as the object.
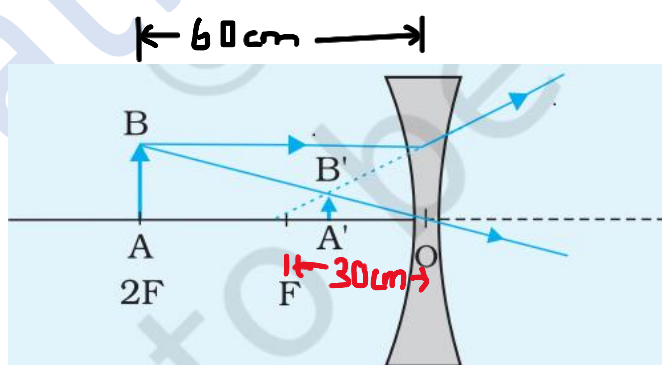
25. *(a) A wire of resistance R is cut into three equal parts. If these three parts are then joined in parallel, calculate the total resistance of the combination so formed.*　　*2*

OR

(b) Define electric power. When do we say that the power consumed in an electric circuit is 1 watt?　　*2*
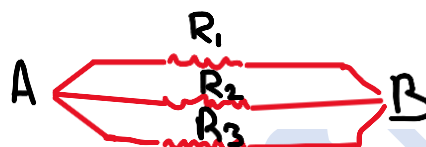
Solution: 25 (a)

When a wire of resistance R is cut into three equal parts, then
Resistance of each part = R1 = R2 = R3 = R/3 (Shown in fig. below)

If these three parts are joined in parallel then,

equivalent resistance Req for resistors is given by:

$$\frac{1}{Req} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3}$$

$$= \frac{1}{R/3} + \frac{1}{R/3} + \frac{1}{R/3}$$

$$= \frac{3}{R} + \frac{3}{R} + \frac{3}{R}$$

$$= \frac{9}{R}$$

$$Req = \frac{R}{9}$$

Solution: 25(b)

Electric power is the rate at which electrical energy is consumed or transferred in an electric circuit. It is the amount of work done (or energy dissipated) per unit time in an electrical component or circuit.

Mathematically, electric power (P) is given by:

$$P = V \times I \qquad \text{where:} \quad P = \text{Power (in watts, W)}$$
$$V = \text{Voltage (in volts, V)}$$
$$I = \text{Current (in amperes, A)}$$

When 1 ampere (1 A) of current flows through a component with a potential difference of 1 volt (1 V) across it, then we can say that the power consumed is 1 Watt.

26. "Excessive use of chemicals and pesticides in agriculture adversely effect the environment." Justify this statement.   2

Solution:

The excessive and indiscriminate use of chemical fertilizers and pesticides in agriculture has serious negative impacts on the environment. Synthetic fertilizers such as urea and phosphates disrupt the natural nutrient cycle, depleting organic matter and reducing microbial activity in the soil. Prolonged use of these chemicals can also alter soil pH, ultimately decreasing soil fertility. Harmful pesticides like DDT and glyphosate can leach into groundwater, posing significant health risks to humans and animals. Additionally, some pesticides evaporate into the atmosphere, contributing to air pollution, smog formation, and respiratory problems.

SECTION C

*Questions no. **27** to **33** are Short Answer Type questions.*

27. *(a) "Displacement reactions also play a key role in extracting metals in the middle of the reactivity series." Justify this statement with two examples.*

(b) Why can metals high up in the reactivity series not be obtained by reduction of their oxides by carbon ?   *3*

Solution: 27(a)

Displacement reactions are crucial for extracting metals in the middle of the reactivity series because a more reactive metal can displace a less reactive metal from its compound. This principle allows for the isolation of metals that are difficult to obtain through other methods.
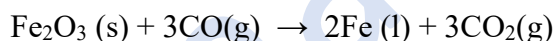
Examples:

1. **Extraction of Zinc from Zinc Oxide:**

    ZnO (s) + C (s) $\rightarrow$ Zn (l) + CO (g)
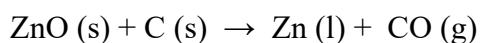
Carbon is more reactive than zinc. It displaces zinc from zinc oxide by reduction, forming zinc metal.

2. **Extraction of Iron from Iron (III) Oxide:**

    Fe_2O_3 (s) + 3CO(g) $\rightarrow$ 2Fe (l) + 3CO$_2$(g)

Carbon monoxide (a reducing agent derived from coke) displaces iron from iron oxide. Iron is extracted by this displacement reaction in a blast furnace.

Solution: 27(b) Metals high in the reactivity series form very stable compounds. These **cannot be reduced by carbon**, so their extraction requires **electrolytic methods**, which can provide the high energy needed to break the strong bonds.

Example:

Aluminium oxide (Al_2O_3) is extremely stable. Carbon cannot reduce Al_2O_3 to aluminium. Therefore, aluminium is extracted using electrolysis of molten aluminium oxide.

28. *(a) With the help of an activity, explain the conditions under which iron articles get rusted.*
                                                        OR   *3*
(b) (i) Name two metals which react violently with cold water. List any three observations which a student notes when these metal are dropped in a beaker containing water.
(ii) Write a test to identify the gas evolved (if any) during the reaction of these metals with water.   *3*

Solution 28(a)
Iron articles rust when exposed to both moisture and oxygen. This can be demonstrated through a simple activity involving three test tubes, clean iron nails, water, boiled water, oil, anhydrous calcium chloride (a drying agent), and cotton plugs or corks.

In **Test Tube 1**, a clean iron nail is placed in the tube, and some water is added. The test tube is left open to air. This setup provides both moisture and oxygen, the two essential components for rusting.

In **Test Tube 2**, boiled distilled water is added to remove dissolved oxygen. A thin layer of oil is carefully poured over the water to prevent air from entering. A clean nail is then placed inside, and the test tube is sealed. This setup contains water but no oxygen.

In **Test Tube 3**, anhydrous calcium chloride is added to absorb any moisture present. A clean nail is placed inside, and the tube is sealed with a cork or cotton plug to prevent air from entering. This setup contains dry air (oxygen) but no moisture.

Observations:

After a few days, observations are made. The nail in **Test Tube 1** shows clear signs of rust, indicating that rusting occurs in the presence of both water and air. In contrast, the nails in **Test Tubes 2 and 3** show little to no rusting. This confirms that **both oxygen and moisture are necessary for rusting to take place**. If either component is missing, rusting does not occur.

Thus, the activity clearly demonstrates that iron articles rust only when they are exposed to **both moisture and oxygen**.

Solution: 28(b)(i)

The two metals which react violently with cold water are:

1. Sodium (Na)
2. Potassium (K)

The three observations which a student notes when these metals are dropped in a beaker containing water are:

1. Rapid evolution of hydrogen gas is seen as bubbles on the metal's surface.
2. The reaction is highly exothermic. A significant amount of heat is released.
3. The metal floats on the surface of water.

Solution: 28(b)(ii)

To identify the gas evolved, the following steps are taken:

- The gas produced during the reaction is passed through a soap solution, forming soap bubbles filled with the gas.
- These bubbles rise up in the air.
- When a burning candle or matchstick is brought near the soap bubbles, the gas burns with a 'pop' sound.

Thus, the 'pop' sound confirms that the gas evolved is hydrogen.

29. Plants have neither a nervous system nor muscles, even then they respond to stimuli. For example, the leaves of chhui-mui (touch-me-not) plant when touched begin to fold up and droop.

(a) How is the information communicated in "touch-me-not" plants ?

(b) What enables the plant cells to bring out the observable response ?   3

(c) Differentiate the movement mentioned above from the movement of tendrils in a pea plant.

Solution: 29(a)

In the case of **touch-me-not plant (Chhui-mui)**, the information is communicated through **electrical-chemical signals**. When the plant is touched, cells in the affected area generate electrical impulses that **travel from cell to cell**, causing a response in nearby cells.

Solution: 29(b)

The observable response (folding and drooping of leaves) is brought about by changes in the turgor pressure of cells. The cells at the base of the leaflets and petiole lose water and become flaccid, which causes the leaves to fold and droop.

Solution: 29(c)

The differences between the movement of touch me not plant and the tendrils in Pea Plant are given below:

Touch-me-not Plant	Tendrils in Pea Plant
It shows nastic movement (non-directional).	It shows tropic movement (directional/ growth based).
The movement of touch me not plant is rapid.	The movement of tendrils in pea plant is slow
The change is caused by turgor pressure and is reversible.	It involves differential growth rates on different sides of the tendril, causing it to coil around a support.

30. *(a) What are chromosomes?*

(b) Explain in brief how stability of DNA content of a species is ensured in sexually reproducing organisms?   *3*

Solution: 30 (a)

Chromosomes are thread-like structures made of DNA and proteins found in the nucleus of cells. They carry genetic information in the form of genes, which determine the inherited traits of an organism. For example, in humans, there are 46 chromosomes arranged in 23 pairs.

30 (b) The stability of DNA content in sexually reproducing organisms is maintained through meiosis and fertilization. During meiosis, the chromosome number is halved in gametes, preventing doubling in each generation. Gametes (sperm and egg) are haploid and carry only one set of chromosomes. At fertilization, the fusion of two haploid gametes restores the diploid chromosome number. This precise coordination ensures genetic continuity and stability of DNA content across generations.

31. *Draw ray diagrams to show the nature, position and relative size of the image formed by a convex mirror when the object is placed (i) at infinity and (ii) between infinity and pole P of the mirror.* 3

Solution: 31 (i)

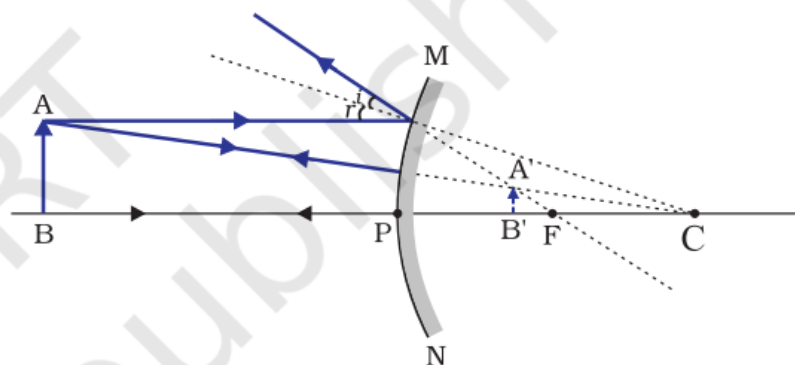Image formed by the convex mirror when the object is placed at infinity is shown below:
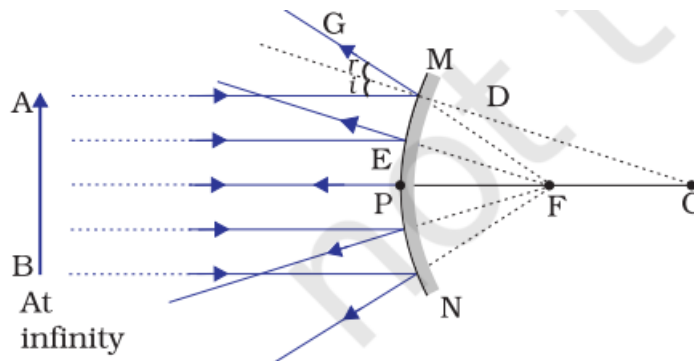
Nature of image – Virtual and erect.

Position of the image – At the focal point behind the mirror

Size of the image – highly diminished, point sized.

Solution: 31 (ii) Image formed by the convex mirror when the object is placed between infinity and the Pole P of the mirror is shown below:

Nature of the image – Virtual and erect

Position of the image – between the Pole (P) and Focal Point (F) behind the mirror

Size of the image – diminished.

32. *Consider the following electric circuit:*
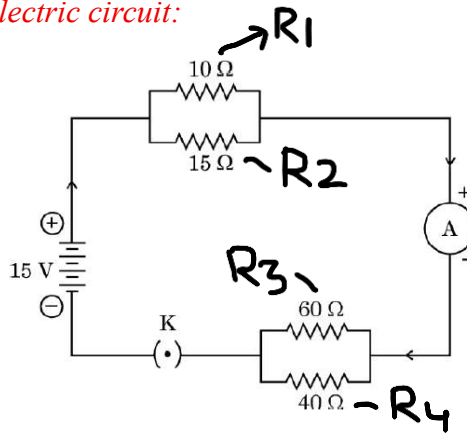
Calculate the values of the following: *3*

(a) The total resistance of the circuit

(b) The total current drawn from the source

(c) Potential difference across the parallel combination of 10 Ω and 15 Ω resistors.

Solution:**32 (a)**

Given:

Battery Voltage, V=15 V

Resistors:

R1=10 Ω

R2=15 Ω   } — Say

R3=60 Ω

R4=40 Ω

Since R1 and R2 is in parallel combination, hence

$$\frac{1}{Rp1} = \frac{1}{R1} + \frac{1}{R2}$$

$$= \frac{1}{10} + \frac{1}{15}$$

$$= \frac{5}{30}$$

$$= \frac{1}{6}$$

$$Rp1 = 6 \, \Omega$$

Similarly, R3 and R4 is in parallel combination, hence

$$\frac{1}{Rp2} = \frac{1}{R3} + \frac{1}{R4}$$

$$= \frac{1}{60} + \frac{1}{40}$$

$$= \frac{5}{120}$$

$$= \frac{1}{24}$$

$$Rp2 = 24 \text{ } \Omega$$

Now, the two equivalent resistances $R_{P1}=6 \text{ } \Omega$ and $R_{P2}=24 \text{ } \Omega$ are connected in series.

Total resistance of the circuit (R_{total}) = R_{P1} + R_{P2} = 6 Ω + 24 Ω = **30 Ω.** **(Ans.)**

Solution:32(b)

Given,

Voltage of the battery = 15 V

Using Ohm`s law,   V = I x R

I = V/R_{total}

= 15/30 (after putting the value)

= 1/2 = 0.5 A **(Ans.)**

Solution: 32(c)

In the potential difference across the parallel combination of 10 Ω and 15 Ω resistors, the $R_{P1}=6 \text{ } \Omega$ and the current (I) = 0.5 A

$$V = I \text{ x } R_{P1}$$

$$V = 0.5 \text{ x } 6$$

$$V = 3 \text{ V } \textbf{(Ans.)}$$

33. (a) Write the relationship between resistivity and resistance of a cylindrical conductor of length l and area of cross-section A. Hence derive the SI unit of resistivity.

(b) Why are alloys used in electrical heating devices?   *3*

Solution: 33(a)

The resistance (R) of a cylindrical conductor is directly proportional to its length (l) and inversely proportional to its cross-sectional area (A). The relationship is shown below:

$$R = \rho \cdot \frac{l}{A}$$

(*Where, ρ is the electrical resistivity of the cylindrical conductor*)

$$\rho = .R\frac{A}{l}$$

Substituting with their SI units, we get:

$$\rho = \Omega \; \frac{m^2}{m} \;\; = \Omega \cdot m$$

(Resistance R has the SI unit ohm (Ω), Cross-sectional Area A is measured in square meters (m²) and Length l is measured in meters (m))

Therefore, the SI unit of resistivity is ohm meter (Ω·m).

Solution:33 (b)

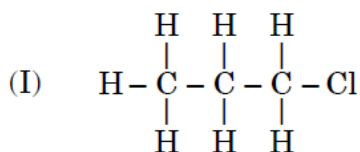Alloys are used in heating devices because of the following reasons:

1. Alloys have high resistivity.
2. Alloys have high melting point.
3. Alloys do not oxidize easily.

SECTION D

*Questions no. **34** to **36** are Long Answer Type questions.*

34. *(a) (i) Draw two isomeric structures of Butene (C₄H₈).*

(ii) Name the following compounds:

(I)

```
        H   H   H
        |   |   |
H – C – C – C – Cl
        |   |   |
        H   H   H
```

(II)

```
        H   H       H
        |   |       |
H – C – C – C – C – H
        |   |   ‖   |
        H   H   O   H
```
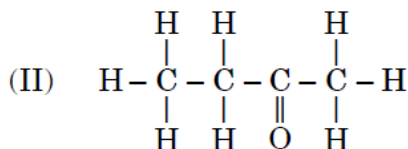
(iii) Write the chemical equations for the following reactions. Mention one essential condition each for these reactions to take place.

(I) Ethanol undergoes complete oxidation

Solution: 34 (a)(i)

The two isomeric structures of Butene (C_4H_8) are given below:

    (a)   CH2=CH-CH2-CH3   (1-Butene)
    (b)   CH3-CH=CH-CH3   (2-Butene)

Solution: 34(a) (ii)

The name of the first compound is Chloropropane.

   The name of the second compound is butanal.

Solution: 34 (a) (iii)

(I) Ethanol undergoes complete oxidation

When ethanol undergoes **complete oxidation**, it is fully broken down into carbon dioxide (CO_2) and water (H_2O) with the release of energy.

$$C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O + \textbf{Energy}$$

(II) Propene undergoes hydrogenation

Propene (C3H6), an alkene, undergoes hydrogenation to produce propane (C_3H_8).

$$CH_3-CH = CH_2 + H_2 \xrightarrow{\text{Ni, heat}} CH_3-CH_2-CH_3$$
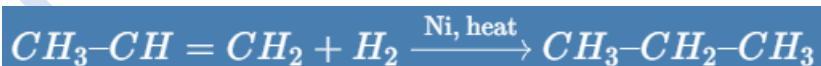
(III) Ethanoic acid reacts with ethanol

When ethanoic acid (CH_3COOH) reacts with ethanol (C_2H_5OH) in the presence of an acid catalyst (typically conc. H_2SO_4), an esterification reaction occurs, producing ethyl acetate (ester) and water.

$$CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$$

OR

Solution 34 (b) (i)

The given information suggests that compound **X** is a good solvent and reacts with sodium to form two products, **Y** and **Z**, where **Z** is used in the hydrogenation of vegetable oil to vegetable ghee.

- Since **X** is a good solvent and reacts with sodium to form two products, it is likely an **alcohol**. The most common alcohol used as a solvent is **ethanol (C_2H_5OH)**.

- When ethanol reacts with sodium (Na), it forms Sodium ethoxide (C_2H_5ONa) and hydrogen gas (H_2) is produced. However, Z is described as being used to convert vegetable oil into vegetable ghee (hydrogenation process), so Z must be hydrogen gas (H_2).

- Therefore,   X = Ethanol

  - Y = Sodium ethoxide

  - Z = Hydrogen

  The chemical equation is given below:

$$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2 \uparrow$$

Solution 34 (b) (ii)
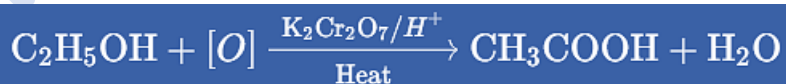
(I) When ethanol burns in oxygen/ air:

Ethanol reacts with oxygen to produce carbon dioxide and water, releasing heat and light.

$$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$$

(II) When ethanol is heated at 443 K in excess conc. H2SO4:
Ethanol undergoes dehydration, losing a water molecule to form ethene.

$$C_2H_5OH + [O] \xrightarrow[\text{Heat}]{K_2Cr_2O_7/H^+} CH_3COOH + H_2O$$
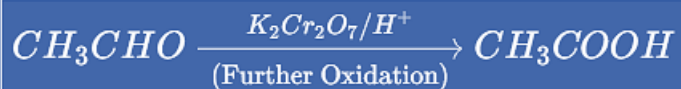
(III) When ethanol reacts with acidified potassium dichromate:
When ethanol is oxidized using acidified potassium dichromate ($K_2Cr_2O_7/H^+$), it first forms acetaldehyde (CH_3CHO) and then further oxidizes to form acetic acid (CH_3COOH).
Ethanol → Acetaldehyde

$$C_2H_5OH \xrightarrow[\text{(Oxidation)}]{K_2Cr_2O_7/H^+} CH_3CHO + H_2O$$
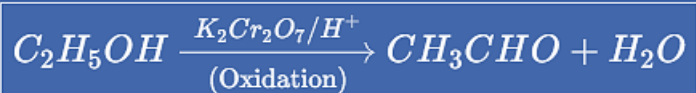
Acetaldehyde → Acetic Acid

$$CH_3CHO \xrightarrow[\text{(Further Oxidation)}]{K_2Cr_2O_7/H^+} CH_3COOH$$

35. *(a) (i) Write the functions of the following parts of human female reproductive system :*
(I) Ovary
(II) Fallopian tube
(III) Uterus
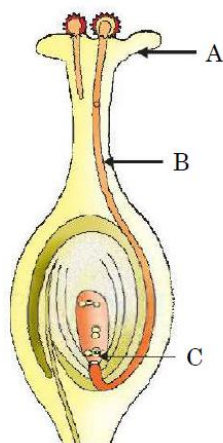*(ii) State briefly two contraceptive methods used by human males.* 5

OR

(b) (i) Differentiate between self-pollination and cross-pollination.
(ii) Identify A, B and C in the diagram given below and write one function of each. 5

Solution: 35 (a) (i)

(I) Ovary: The primary function of ovary is to produce female gametes (eggs). The ovary is also responsible for producing essential female sex harmones like estrogen (for menstrual cycle regulation) and progesterone (for maintaining pregnancy).

(II) Fallopian tube: The fallopian tubes act as a conduit, carrying the egg from the ovary to the uterus.This is site where fertilization typically occurs when the sperm meets the eggs.

(III) Uterus: The uterus is where a fertilized egg (zygote) implants and where the embryo and fetus develop during pregnancy. The uterine lining (endometrium) thickens each month in preparation for a potential pregnancy, and is shed during menstruation if fertilization does not occur. The uterus plays a crucial role in childbirth by contracting to expel the baby during labor.

Solution 35 (a) (ii)

Two contraceptive methods used by human males are:

(i) **Condoms**: It prevents sperm from entering the female reproductive tract, thereby avoiding fertilization.
(ii) **Vasectomy**: A surgical procedure in which the **vas deferens** (sperm-carrying tubes) are cut and sealed. This prevents sperm from mixing with semen, making a man sterile while still allowing normal sexual function.

OR

Solution 35 (b) (i)

The main difference between self-pollination and cross-pollination are:

Self-Pollination	Cross-Pollination
1. Transfer of pollen from the anther to the stigma of the same flower or another flower on the same plant.	1. Transfer of pollen from the anther of one plant to the stigma of a flower on a different plant of the same species.
2. No or very little genetic variation; offspring are genetically similar to the parent.	2. Promotes genetic variation; offspring show differences from parents.
3. Usually does not require external pollinating agents.	3. Requires agents like wind, water, insects, or animals.
4. Often occurs in bisexual flowers.	4. Usually occurs in unisexual or widely spaced bisexual flowers.

Solution 35 (b) (ii)
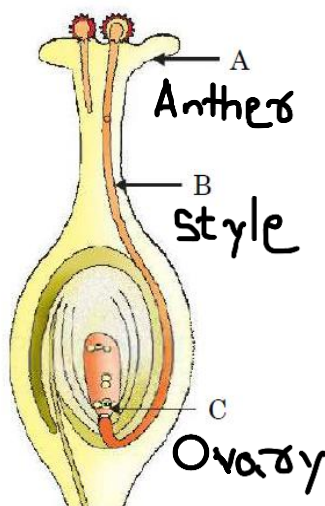
A – Anther: Function: it produces pollen grains which are the male gamettes.
B: Style; Function: it supports the stigma and helps transport pollen to the ovary.
C: Ovary; Function: It contains ovules, which house the female gametes (egg cells). After fertilization, the ovary develops into a fruit, and the ovules develop into seeds.

36. *(a) (i) The power of a lens 'X' is – 2·5 D. Name the lens and determine its focal length in cm. For which eye defect of vision will an optician prescribe this type of lens as a corrective lens ?*

(ii) "The value of magnification 'm' for a lens is – 2." Using new Cartesian Sign Convention and considering that an object is placed at a distance of 20 cm from the optical centre of this lens, state :

> *(I) the nature of the image formed;*
> *(II) size of the image compared to the size of the object;*
> *(III) position of the image, and*
> *(IV) sign of the height of the image.*

(iii) The numerical values of the focal lengths of two lenses A and B are 10 cm and 20 cm respectively. Which one of the two will show higher degree of convergence/divergence? Give reason to justify your answer. 5

OR

(b) (i) Draw a ray diagram to show the refraction of a ray of light through a rectangular glass slab when it falls obliquely from air into glass.

(ii) State Snell's law of refraction of light.

(iii) Differentiate between the virtual images formed by a convex lens and a concave lens on the basis of :

(I) object distance, and

(II) magnification. 5

Solution: 36 (a) (i)

Given,

The power of a lens 'X' is – 2.5 D.

Since the power is negative, the lens 'X' is a concave lens i.e. diverging lens.

Using the lens formula,

$$P = \frac{1}{f}$$

$$f = \frac{1}{p}$$

$$f = -\frac{1}{2.5} = -0.4 \text{ m} = -0.4 \times 100 \text{ cm} = -40 \text{ cm}$$

Hence, focal length of the lens = – 40 cm.

A concave lens (diverging lens) is used to correct myopia (near sightedness). Myopia is a condition where a person can see nearby objects clearly but distant objects appear blurred. This occurs because the eye's lens focuses light in front of the retina instead of on it. A concave lens diverges light rays, shifting the focus backward onto the retina, thus correcting the vision.

Solution 36 (a) (ii)

Given:

Magnification (m) = –2

(I) the nature of the image formed;

Since magnification is negative, the image is real and inverted.

(II) size of the image compared to the size of the object;
We know that, If $|m|>1 \rightarrow$ Image is enlarged.
If $|m|<1 \rightarrow$ Image is diminished.
Here, the magnitude of magnification is $|m|=2$, which means the image is twice the size of the object.

(III) position of the image
Given,
Magnification (m) = −2 and distance of the object (u) = −20 cm

Using the magnification formula,

$$m = \frac{v}{u}$$
$$v = m \times u = -2 \times -20 = 40 \text{ cm}$$

Since v = 40 cm (positive), the image is formed 40 cm on the opposite side of the lens from the object.

(IV) sign of the height of the image.
The height of the image (**h'**) is related to the height of the object (**h**) by:

$h' = m \times h = -2h$

The negative sign indicates that the image is inverted relative to the object.

Solution: 36 (a) (iii)

Given,

Lens A, focal length (F_A) = 10 cm = 0.1 m

Lens B, focal length (F_B) = 20 cm = 0.2 m

Using the formula,
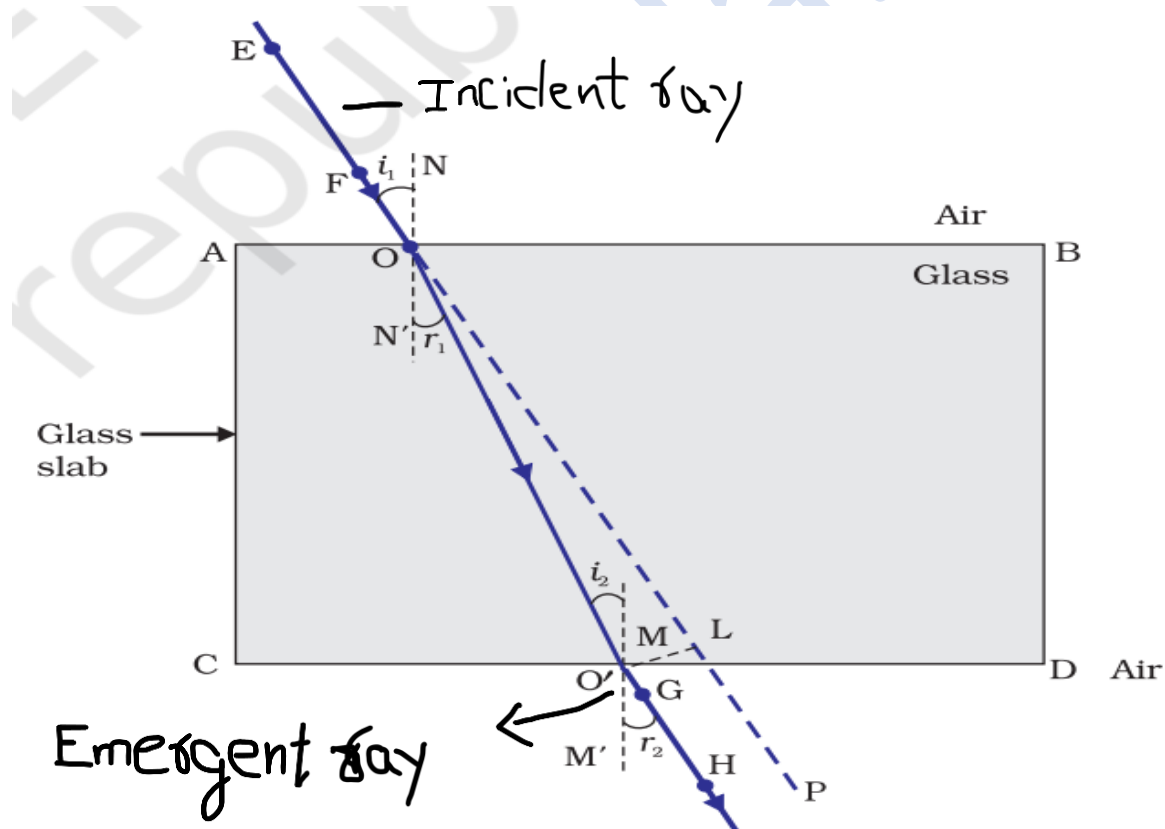
$$P = \frac{1}{f}$$

Power of lens A $= \frac{1}{FA} = \frac{1}{0.1} = +10\ D$

Power of lens B $= \frac{1}{FB} = \frac{1}{0.2} = +5\ D$

Since, lens A has higher power than lens B. lens A will show higher degree of convergence/divergence.

Solution: 36 (b) (i)

Figure 9.10
Refraction of light through a rectangular glass slab

Solution: 36 (b) (ii)

Snell's Law (also called the Law of Refraction) describes how light bends when it passes from one transparent medium to another with a different optical density. According to snell`s law:

The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant for a given pair of media.

Mathematically, it is expressed as:

$$\frac{Sin\ i}{Sin\ r} = constant$$

Solution 36 (b) (iii)

(I) **Object distance:**

Convex Lens: A virtual image is formed when the object is placed between the center and the focal point of the convex lens.

Concave Lens: A virtual image is formed regardless of the object's distance from the concave lens.

(II) Magnification:

Convex Lens: The virtual image formed by a convex lens is magnified, meaning it appears larger than the object.

Concave Lens: The virtual image formed by a concave lens is diminished, meaning it appears smaller than the object.

SECTION E

The following questions are Source-based/Case-based questions. Read the case carefully and answer the questions that follow.

37. Seawater contains many salts dissolved in it. Common salt is separated from these salts. Deposits of solid salt are also found in several parts of the world. These large crystals are often brown due to impurities. This is called rock salt and is mined like coal. The common salt is an important raw material for chemicals of daily use.

(a) Write balanced chemical equations to show the products formed during electrolysis of brine.

(b) List two uses of any one product obtained during electrolysis of brine.   *2*

(c) (i) A mild non-corrosive basic salt 'A', used for faster cooking, is strongly heated to produce a compound 'B', that is used for removing permanent hardness of water. Identify A and B and also write the equation for the reaction that occurs when A is heated.   *2*
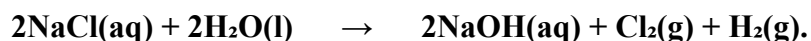
OR

(c) (ii) Define water of crystallisation. Give two examples of salts that have water of crystallisation.   *2*

Solution: 37 (a)

Electrolysis of brine (concentrated sodium chloride solution) produces chlorine gas, hydrogen gas, and sodium hydroxide.

The balanced chemical equation is:

$$2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g).$$

Solution: 37 (b)

Two uses of any one product obtained during electrolysis of brine:

1. Chlorine is used to disinfect drinking water and swimming pools.

2. Chlorine is used in manufacturing of PVC pipes.

Solution: 37 (c) (i)

The mild non-corrosive basic salt (A) that is used for faster cooking is sodium bicarbonate ($NaHCO_3$), also known as baking soda.

When sodium bicarbonate (A) is strongly heated, it decomposes to form sodium carbonate (Na_2CO_3) ('B'), which is used for removing permanent hardness of water.

Solution: 37 (c) (ii)

Water of crystallisation refers to the fixed number of water molecules chemically bonded to the salt in its crystalline form. These water molecules are essential for maintaining the structure and appearance (often colour) of the crystals.

The two examples are:

1. **Copper (II) sulphate pentahydrate** – $CuSO_4 \cdot 5H_2O$ (Blue crystals)

2. **Washing soda** – $Na_2CO_3 \cdot 10H_2O$ (Transparent crystalline solid)

38. The maintenance functions of all living organisms must go on even when they are not doing anything particular. Even when we are just sitting in a class or even asleep, this maintenance job has to go on. These maintenance processes require energy to prevent damage and break-down of cells and tissues, which is obtained by the individual organism from the food prepared by the autotrophs, called producers.

(a) Name and define the process by which green plants prepare food.   *1*

(b) Write chemical equation involved in the above process.   *1*

(c) (i) State in proper sequence the events that occur in synthesis of food by desert plants. 2

<div align="center">

OR

</div>

(c) (ii) Explain giving reasons what happens to the rate at which the green plants will prepare food   *2*

(I) during cloudy weather, and

(II) when stomata get blocked due to dust.

Solution: 38 (a)

Photosynthesis is the process by which green plants prepare their own food. It is defined as the conversion of light energy into chemical energy, where plants use carbon dioxide and water to produce glucose (a form of sugar) and release oxygen as a by-product.

Solution: 38 (b)

The chemical equation for photosynthesis is:

$$6CO_2 + 6H_2O \xrightarrow[\text{\textcolor{green}{Chlorophyll}}]{\text{\textcolor{red}{Light energy}}} C_6H_{12}O_6 + 6O_2$$
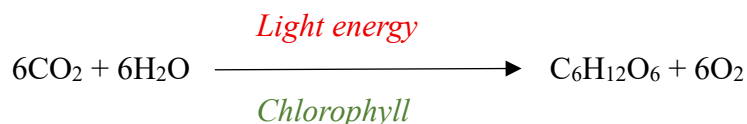
Solution: 38 (c) (i)

Desert plants synthesize their food through a process called Crassulacean Acid Metabolism (CAM), which allows them to conserve water while photosynthesizing. The sequence of events involves:

(1) Stomata open at night: Stomata open at night to absorb carbon dioxide due to lower temperatures and higher humidity, minimizing water loss.

(2) CO_2 storage: The absorbed CO_2 is converted into organic acids (like malic acid) and stored in the plant's vacuoles.

(3) Stomata close during the day: To prevent water loss, stomata remain closed during the day.

(4) Stored CO_2 is released from acids: During the daytime, CO_2 is released from the stored organic acids inside the leaf cells.

(5) Photosynthesis takes place using released CO_2: The chlorophyll captures sunlight and uses it along with the released CO_2 and water to synthesize glucose (food) through photosynthesis.

Solution: 38 (c) (ii) (I)

The rate of manufacturing food by green plants decreases.

Explanation: Cloudy weather reduces the intensity of sunlight. With less light energy available, chlorophyll absorbs less sunlight consequently slowing down the process of converting carbon dioxide and water into glucose (food).

Solution: 38 (c) (ii) (II)

The rate of manufacturing food by green plants decreases.

Explanation: When stomata are blocked due to dust, the exchange of gases (carbon dioxide in and oxygen out) is hindered. This blockage reduces the availability of carbon dioxide for photosynthesis, further decreasing the rate at which plants can prepare food.

39. In our homes, we receive the supply of electric power through a main supply also called mains, either supported through overhead electric poles or by underground cables. In our

(a) Write the colours of the insulation covers of the line wires through which supply comes to our homes.   *1*

(b) What should be the current rating of the electric circuit (220 V) so that an electric iron of 1 kW power rating can be operated?   *1*

(c) (i) What is the function of the earth wire? State the advantage of the earth wire in domestic electric appliances such as electric iron.   *2*

<div align="center">***OR***</div>

(c) (ii) List two precautions to be taken to avoid electrical accidents. State how these precautions prevent possible damage to the circuit/appliance.   *2*

Solution: 39 (a) As per standard electrical conventions, the colours of the insulation covers of the lines wires in India are:

     Live wire - Red or Brown

     Neutral wire – Black or Blue

     Earth wire – Green or Green with Yellow

Solution: (b) Current rating of the electric circuit for a 1 kW electric iron:

Given:

- Power (P) = 1 kW = 1000 W

- Voltage (V) = 220 V

Using the formula:

$$\text{Power} = \text{Voltage} \times \text{Current}$$

$$\text{Current} = \frac{\text{power}}{\text{Voltage}}$$

$$= \frac{1000 \text{ w}}{220 \text{ v}} = 4.55 \text{ A}$$

So, the current rating of the circuit should be at least 5 A to safely operate the 1 kW iron.

Solution: (C) (i) The main function of the earth wire is to provide a low-resistance path for electric current to flow into the ground in case of a fault.

The advantage of the earth wire in domestic electric appliances, such as an electric iron, is that if the live wire accidentally comes in contact with the metal casing, the earth wire safely carries the leakage current to the ground. This prevents the metal case from becoming live, thereby reducing the risk of electric shock to the user.

OR

Solution: (C) (ii)

The two precautions to be taken to avoid electrical accidents are:

(i) Use Proper Fuses or Circuit Breakers of Correct Rating:

<u>How it helps:</u>

Fuses or circuit breakers automatically disconnect the power supply in case of an overload or short circuit. This helps prevent fire hazards and ensures the safety of both the users and electrical appliances.

(ii) Ensure Proper Earthing (Grounding) of Appliances

<u>How it helps:</u>

Earthing provides a safe, low-resistance path for fault current to flow into the ground. This protects users from electric shocks and prevents damage to appliances caused by current leakage.