

CBSE Board Examination - 2024

SCIENCE (Theory)

Solved Paper

Class-10th

Time allowed: 3 hours

Maximum Marks: 80

General Instructions:

- (i) This question paper contains 39 questions, All questions are compulsory.
- (ii) This question paper is divided into five Sections - Section 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 and 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 30 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 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.

Delhi Set-1

31/1/1

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.

1. When 2 mL of sodium hydroxide solution is added to few pieces of granulated zinc in a test tube and then warmed, the reaction that occurs can be written in the form of a balanced chemical equation as: 1
(A) $\text{NaOH} + \text{Zn} \rightarrow \text{NaZnO}_2 + \text{H}_2\text{O}$
(B) $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2$
(C) $2\text{NaOH} + \text{Zn} \rightarrow \text{NaZnO}_2 + \text{H}_2$
(D) $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2\text{O}$
 2. Select from the following a decomposition reaction in which source of energy for decomposition is light: 1
(A) $2\text{FeSO}_4 \rightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$
(B) $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
(C) $2\text{AgBr} \rightarrow 2\text{Ag} + \text{Br}_2$
(D) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
 3. A metal and a non-metal that exists in liquid state at the room temperature are respectively: 1
(A) Bromine and Mercury
(B) Mercury and Iodine
(C) Mercury and Bromine
(D) Iodine and Mercury
 4. Carbon compounds:
(i) are good conductors of electricity.
(ii) are bad conductors of electricity.
(iii) have strong forces of attraction between their molecules.
(iv) have weak forces of attraction between their molecules.
- The correct statements are: 1
(A) (i) and (ii) (B) (ii) and (iii)
(C) (ii) and (iv) (D) (i) and (iii)
5. Consider the following compounds:
 FeSO_4 ; CuSO_4 ; CaSO_4 ; Na_2CO_3
The compound having maximum number of water of crystallisation in its crystalline form in one molecule is: 1
(A) FeSO_4 (B) CuSO_4
(C) CaSO_4 (D) Na_2CO_3
 6. Oxides of aluminium and zinc are: 1
(A) acidic (B) basic
(C) amphoteric (D) neutral
 7. $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$
The reaction given above is a redox reaction because in this case: 1
(A) MnO_2 is oxidised and HCl is reduced.
(B) HCl is oxidised.
(C) MnO_2 is reduced.
(D) MnO_2 is reduced and HCl is oxidised.
 8. Consider the following statements:
(i) The sex of a child is determined by what it inherits from the mother.
(ii) The sex of a child is determined by what it inherits from the father.

- (iii) The probability of having a male child is more than that of a female child.
- (iv) The sex of a child is determined at the time of fertilisation when male and female gametes fuse to form a zygote.

The correct statements are: **1**

- (A) (i) and (iii) (B) (ii) and (iv)
 (C) (iii) and (iv) (D) (i), (iii) and (iv)

9. Chromosomes:

- (i) carry hereditary information from parents to the next generation.
- (ii) are thread like structures located inside the nucleus of an animal cell.
- (iii) always exist in pairs in human reproductive cells.
- (iv) are involved in the process of cell division.

The correct statements are: **1**

- (A) (i) and (ii)
 (B) (iii) and (iv)
 (C) (i), (ii) and (iv)
 (D) (i) and (iv)

10. In a nerve cell, the site where the electrical impulse is converted into a chemical signal is known as: **1**

- (A) Axon
 (B) Dendrites
 (C) Neuromuscular junction
 (D) Cell body

11. A stomata closes when:

- (i) it needs carbon dioxide for photosynthesis.
- (ii) it does not need carbon dioxide for photosynthesis.
- (iii) water flows out of the guard cells.
- (iv) water flows into the guard cells.

The correct reason(s) in this process is/are: **1**

- (A) (i) only (B) (i) and (iii)
 (C) (ii) and (iii) (D) (ii) and (iv)

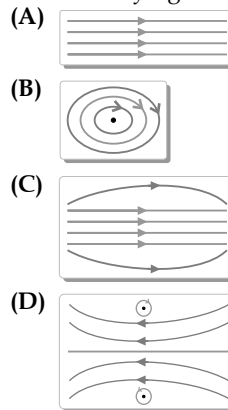
12. At what distance from a convex lens should an object be placed to get an image of the same size as that of the object on a screen? **1**

- (A) Beyond twice the focal length of the lens.
 (B) At the principal focus of the lens.
 (C) At twice the focal length of the lens.
 (D) Between the optical centre of the lens and its principal focus.

13. The lens system of the human eye forms an image on a light sensitive screen, which is called as: **1**

- (A) Cornea (B) Ciliary muscles
 (C) Optic nerves (D) Retina

14. The pattern of the magnetic field produced inside a current carrying solenoid is: **1**



15. Identify the food chain in which the organisms of the second trophic level are missing: **1**

- (A) Grass, goat, lion
 (B) Zooplankton, phytoplankton, small fish, large fish
 (C) Tiger, grass, snake, frog
 (D) Grasshopper, grass, snake, frog, eagle

16. In which of the following organisms, multiple fission is a means of asexual reproduction? **1**

- (A) Yeast
 (B) *Leishmania*
 (C) *Paramecium*
 (D) *Plasmodium*

For Q. Nos. 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 the Assertion (A).
- (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the 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):** Hydrogen gas is not evolved when zinc reacts with nitric acid.

Reason (R): Nitric acid oxidises the hydrogen gas produced to water and itself gets reduced. **1**

18. **Assertion (A):** Accumulation of harmful chemicals is maximum in the organisms at the highest trophic level of a food chain.

Reason (R): Harmful chemicals are sprayed on the crops to protect them from diseases and pests. **1**

19. **Assertion (A):** The rate of breathing in aquatic organisms is much faster than in terrestrial organisms.

Reason (R): The amount of oxygen dissolved in water is very high as compared to the amount of oxygen in air. 1

20. **Assertion (A):** The rainbow is a natural spectrum of sunlight in the sky.

Reason (R): Rainbow is formed in the sky when the sun is overhead and water droplets are also present in air. 1

SECTION - B

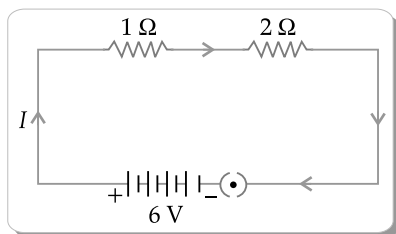
21. Name the type of chemical reaction in which calcium oxide reacts with water. Justify your answer by giving balanced chemical equation for the chemical reaction. 2
22. State one role of each of the following in human digestive system: 2
- Hydrochloric acid
 - Villi
 - Anal Sphincter
 - Lipase
23. (A) How is the movement of leaves of a sensitive plant different from the downward movement of the roots? 2

OR

- (B) There is a hormone which regulates carbohydrate, protein and fat metabolism in our body. Name the hormone and the gland which secretes it. Why is it important for us to have iodised salt in our diet? 2
24. An object is placed at a distance of 10 cm from a convex mirror of focal length 15 cm. Find the position of the image formed by the mirror. 2
25. (A) Show how you would connect three resistors each of resistance $6\ \Omega$, so that the combination has a resistance of $9\ \Omega$. Also justify your answer. 2

OR

- (B) In the given circuit calculate the power consumed in watts in the resistor of $2\ \Omega$: 2



26. (i) Two magnetic field lines do not intersect each other. Why? 2
- (ii) How is a uniform magnetic field in a given region represented? Draw a diagram in support of your answer.

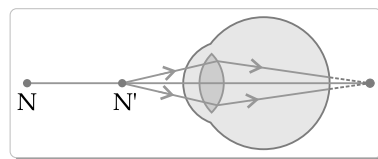
SECTION - C

27. Write one chemical equation each for the chemical reaction in which the following have taken place: 3

- Change in colour
- Change in temperature
- Formation of precipitate

Mention colour change/temperature change (rise/fall)/compound precipitated along with equation.

28. (i) The pH of a sample of tomato juice is 4.6. How is this juice likely to be in taste? Give reason to justify your answer. 1
- (ii) How do we differentiate between a strong acid and a weak base in terms of ion-formation in aqueous solutions? 1
- (iii) The acid rain can make the survival of aquatic animals difficult. How? 1
29. (i) Why is respiratory pigment needed in multicellular organisms with large body size? 1
- (ii) Give reasons for the following: 2
- Rings of cartilage are present in the throat.
 - Lungs always contain a residual volume of air.
 - The diaphragm flattens and ribs are lifted up when we breathe in.
 - Walls of alveoli contain an extensive network of blood vessels.
30. Define reflex action. With the help of a flow chart, show the path of a reflex action such as sneezing. 3
31. Study the diagram given below and answer the questions that follow: 3



- Name the defect of vision represented in the diagram. Give reason for your answer.
 - List two causes of this defect.
 - With the help of a diagram show how this defect of vision is corrected.
32. Name and state the rule to determine the direction of a: 3
- magnetic field produced around a current carrying straight conductor.
 - force experienced by a current carrying straight conductor placed in a magnetic field which is perpendicular to it.
33. (A) Plants → Deer → Lion
- In the given food chain, what will be the impact of removing all the organisms of second trophic

level on the first and third trophic level? Will the impact be the same for the organisms of the third trophic level in the above food chain if they were present in a food web? Justify. 3

OR

- (B) A gas 'X' which is a deadly poison is found at the higher levels of atmosphere and performs an essential function.

Name the gas and write the function performed by this gas in the atmosphere. Which chemical is linked to the decrease in the level of this gas? What measures have been taken by an international organisation to check the depletion of the layer containing this gas? 3

SECTION - D

34. (A) (i) Define a homologous series of carbon compounds. 5
- (ii) Why is the melting and boiling points of C_4H_8 higher than that of C_3H_6 or C_2H_4 ?
- (iii) Why do we **NOT** see any gradation in chemical properties of a homologous series compounds?
- (iv) Write the name and structures of (i) aldehyde and (ii) ketone with molecular form C_3H_6O .

OR

- (B) (i) Write the name and structure of an organic compound 'X' having two carbon atoms in its molecule and its name is suffixed with '-ol'. 5
- (ii) What happens when 'X' is heated with excess concentrated sulphuric acid at 443 K? Write chemical equation for the reaction stating the conditions for the reaction. Also, state the role played by concentrated sulphuric acid in the reaction.
- (iii) Name and draw the electron dot structure of hydrocarbon produced in the above reaction.
35. (A) (i) Name three techniques/devices used by human females to avoid pregnancy. Mention the side effects caused by each. 5
- (ii) What will happen if in a human female (a) fertilisation takes place, (b) an egg is not fertilised?

OR

- (B) (i) Draw a diagram showing spore formation in Rhizopus and label the (a) reproductive and (b) non-reproductive parts. Why does Rhizopus not multiply on a dry slice of bread? 5
- (ii) Name and explain the process by which reproduction takes place in Hydra.
36. (A) (i) Define electric power. Express it in terms of potential difference (V) and resistance (R). 5
- (ii) An electric oven is designed to work on the mains voltage of 220 V. This oven consumes 11

units of electrical energy in 5 hours. Calculate:

- (a) power rating of the oven
 (b) current drawn by the oven
 (c) resistance of the oven when it is red hot

OR

- (B) (i) Write the relation between resistance R and electrical resistivity (ρ) of the material of a conductor in the shape of cylinder of length / and area of cross-section (A). Hence, derive the SI unit of electrical resistivity. 5
- (ii) The resistance of a metal wire of length 3 m is 60 Ω . If the area of cross-section of the wire is $4 \times 10^{-2} \text{ m}^2$, calculate the electrical resistivity of the wire.
- (iii) State how would electrical resistivity be affected if the wire (of part 'ii') is stretched so that its length is doubled. Justify your answer.

SECTION - E

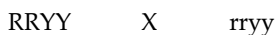
Q. Nos. 37 to 39 are source-based/case-based questions with 2 to 3 short sub-parts. Internal choice is provided in one of these sub-parts:

37. The metals produced by various reduction processes are not very pure. They contain impurities, which must be removed to obtain pure metals. The most widely used method for refining impure metals is electrolytic refining.
- (i) What is the cathode and anode made of in the refining of copper by this process? 1
- (ii) Name the solution used in the above process and write its formula. 1
- (iii) (A) How copper gets refined when electric current is passed in the electrolytic cell? 2

OR

- (B) You have two beakers 'A' and 'B' containing copper sulphate solution. What would you observe after about 2 hours if you dip a strip of zinc in beaker 'A' and a strip of silver in beaker 'B'? Give reason for your observations in each case. 2
38. Mendel worked out the rules of heredity by working on garden pea using a number of visible contrasting characters. He conducted several experiments by making a cross with one or two pairs of contrasting characters of pea plant. On the basis of his observations, he gave some interpretations which helped to study the mechanism of inheritance.
- (i) When Mendel crossed pea plants with pure tall and pure short characteristics to produce F_1 progeny, which two observations were made by him in F_1 plants? 1
- (ii) Write one difference between dominant and recessive trait. 1

- (iii) (A) In a cross with two pairs of contrasting characters



(Round Yellow) (Wrinkled Green)

Mendel observed 4 types of combinations in F_2 generation. By which method did he obtain F_2 generation? Write the ratio of the parental combinations obtained and what conclusions were drawn from this experiment? **2**

OR

- (B) Justify the statement:

"It is possible that a trait is inherited but may not be expressed." **2**

39. Study the data given below showing the focal length of three concave mirrors A, B and C and the respective distances of objects placed in front of the mirrors:

Case	Mirror	Focal Length (cm)	Object Distance (cm)
1	A	20	45
2	B	15	30
3	C	30	20

- (i) In which one of the above cases the mirror will form a diminished image of the object? Justify your answer. **1**
- (ii) List two properties of the image formed in case 2. **1**
- (iii) (A) What is the nature and size of the image formed by mirror C? Draw ray diagram to justify your answer. **2**

OR

- (B) An object is placed at a distance of 18 cm from the pole of a concave mirror of focal length 12 cm. Find the position of the image formed in this case. **2**

Delhi Set-2

31/1/2

Note: Except these, all questions are available in Delhi Set-1.

SECTION - A

4. The name and formula of third member of homologous series of alkyne is: **1**
- (A) Propyne C_3H_6
- (B) Propyne C_3H_4
- (C) Butyne C_4H_8
- (D) Butyne C_4H_6

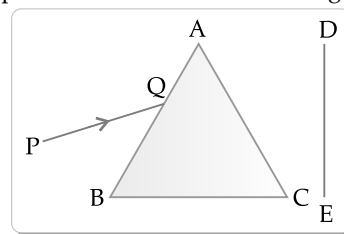
SECTION - B

23. A ray of light falls making an angle of incidence θ on the surface of a glass slab. Draw a labelled ray diagram to show its path. Also mark lateral displacement on it. **2**
24. (A) In which region of the brain is (i) medulla and (ii) cerebrum located? State one function of each. **2**
- OR
- (B) Name a hormone that promotes the growth of tendrils and explain how they help a pea plant to climb up other plants. **2**
25. Mention the pathway of urine in our body starting from the organ of its formation to its excretion. What will happen if the tubular part of the nephron does not work properly? **2**
26. Translate the following statements into chemical equations and then balance them: **2**

- (i) Solution of barium chloride and aluminium sulphate in water react to give insoluble barium sulphate and the solution of aluminium chloride.
- (ii) Aluminium metal reacts with steam to give aluminium oxide and hydrogen gas.

SECTION - C

30. In the context of the statement "chlorophyll is necessary for photosynthesis" answer the following questions: **3**
- (i) What are variegated leaves? Give an example.
- (ii) When leaf is boiled in alcohol, what happens to the colour of the leaf and the colour of the solution?
- (iii) In what form is the carbohydrate produced, stored in the plant? Why is chlorophyll necessary for photosynthesis?
32. A narrow beam, PQ of white light is passing through a glass prism ABC as shown in the diagram.

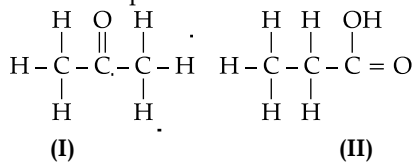


- Draw a ray diagram to show the emergent beam as it falls on the screen DE. Also write the phenomenon involved and its cause. Using the second law of refraction state which colour of light must have the highest value of refractive index amongst seven visible colours of light. Justify your answer. **3**
33. (i) Name two safety measures commonly used in electric circuits and appliances. **3**
- (ii) The power rating of an electric oven is 220 V; 2 kW. If it is used in a domestic electric circuit of

current rating of 5A, what result do you expect? Justify your answer with necessary calculations.

SECTION - D

34. (A) (i) Define the term functional group. Identify the functional groups present in the following carbon compounds: 5



- (ii) What happens when ethanol reacts with

acidified potassium dichromate solution? Write chemical equation for the reaction.

Why is this reaction considered an oxidation reaction?

- (iii) Write chemical equation for the reaction of ethanoic acid with sodium hydroxide.

OR

- (B) (i) Describe method of preparation of soap giving chemical equation for the reaction involved.
(ii) Explain with diagram the mechanism of the cleansing action of soaps.

Delhi Set-3**31/1/3**

Note: Except these, all questions are available in Delhi Set-1 and 2.

SECTION - A

12. Which one of the following organ is NOT a part of human female reproductive system? 1
(A) Ovary (B) Uterus
(C) Vas deferens (D) Fallopian tube
14. In bifocal lenses used for the correction of presbyopia: 1
(A) the upper portion is of convex lens for the near vision and lower part is of concave lens for the distant vision.
(B) the upper portion is of convex lens for the distant vision and lower part is of concave lens for the near vision.
(C) the upper portion is of concave lens is for the near vision and lower part is of convex lens for the distant vision.
(D) the upper portion is of concave lens for the distant vision and lower part is of convex lens for the near vision.

SECTION - B

21. (A) (i) Write the significance of peripheral nervous system in human beings. 2
(ii) How is human brain protected from mechanical injuries and shocks?

OR

- (B) Name one directional growth movement each in response to chemicals and water in plants. Write an example for each of them. 2
22. (i) Give reason why herbivorous animals have longer, small intestine than carnivorous animals? 2
(ii) Although 'Pepsin' and 'Trypsin' are both protein digesting enzymes yet they differ from each other. Justify this statement by giving one difference between them.

23. Translate the following statement into a balanced chemical equation. When barium chloride reacts with aluminium sulphate, aluminium chloride and barium sulphate are formed. State the type of this reaction giving reason to justify your answer. 2
25. Draw the pattern of the magnetic field lines due to a straight current carrying conductor indicating the direction of current in the conductor and the direction of the corresponding magnetic field lines. 2

SECTION - C

31. (i) Which organisms have a three-chambered heart? Why do they have three-chambered hearts? 3
(ii) List two functions of lymph.
32. A compound which is prepared from gypsum has the property of hardening when water is mixed in right quantity with it: 3
(i) Write common name and the chemical name of this compound.
(ii) Give chemical equation for its preparation.
(iii) List its two uses.
33. (i) Define a decomposition reaction. Write chemical equation for the reaction that occurs when lead nitrate is heated strongly in a boiling tube. 3
(ii) In electrolytic decomposition of water two gases are liberated at the electrodes. Give the mass ratio of the gas liberated at the cathode and at the anode.

SECTION - D

34. (A) (i) State whether the currents and potential difference in all the bulbs will be same or different when in a circuit three bulbs of: 5
(a) same wattage are connected in series.
(b) same wattage are connected in parallel.
(c) different wattage are connected in series.
(d) different wattage are connected in parallel.

- (ii) Two identical resistors of 24Ω each are connected to a battery of 6 V . Calculate the ratio of the power consumed by the resulting combinations with (a) minimum resistance and (b) maximum resistance.

OR

- (B) Draw a schematic diagram of a circuit consisting

of a battery of six 2V cells, a 6Ω resistor, a 12Ω resistor and a 18Ω resistor and a plug key all connected in series. Calculate the following (when key is closed):

- (i) Electric current flowing in the circuit.
 (ii) Potential difference across 18Ω resistor.
 (iii) Electric power consumed in 18Ω resistor. 5

Outside Delhi Set-1

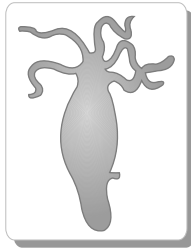
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SECTION-A

- Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by the liberation of heat. From the information given above it may be concluded that this reaction 1
 - is endothermic and pH of the solution formed is more than 7.
 - is exothermic and pH of the solution formed is 7.
 - is endothermic and pH of the solution formed is 7.
 - is exothermic and pH of the solution formed is more than 7.
- Juice of tamarind turns blue litmus to red. It is because of the presence of an acid called: 1
 - methanoic acid
 - acetic acid
 - tartaric acid
 - oxalic acid
- Select from the following a process in which a combination reaction is involved: 1
 - Black and white photography
 - Burning of coal
 - Burning of methane
 - Digestion of food
- The oxide which can react with HCl as well as KOH to give corresponding salt and water is 1
 - CuO (B) Al_2O_3
 - Na_2O (D) K_2O
- Consider the following cases: 1
 - $\text{CaSO}_4 + \text{Al} \rightarrow$
 - $\text{CuSO}_4 + \text{Ca} \rightarrow$
 - $\text{FeSO}_4 + \text{Cu} \rightarrow$
 - $\text{ZnSO}_4 + \text{Mg} \rightarrow$
 The cases in which new products will form are -
 - (a) and (b)
 - (b) and (c)
 - (c) and (d)
 - (b) and (d)
- Identify the correct statement about the following reaction: 1

$$2\text{H}_2\text{S} + \text{SO}_2 \rightarrow 2\text{H}_2\text{O} + \text{S}$$
 - H_2S is oxidising agent and SO_2 is reducing agent.
 - H_2S is reduced to sulphur.
 - SO_2 is oxidising agent and H_2S is reducing agent.
 - SO_2 is oxidised to sulphur.
- Consider the following statements about homologous series of carbon compounds: 1
 - All succeeding members differ by $-\text{CH}_2$ unit.
 - Melting point and boiling point increases with increasing molecular mass.
 - The difference in molecular masses between two successive members is 16 u .
 - C_2H_2 and C_3H_4 are NOT the successive members of alkyne series.
 The correct statements are -
 - (a) and (b) (B) (b) and (c)
 - (a) and (c) (D) (c) and (d)
- Which of the following statement(s) is (are) true about human heart? 1
 - Right atrium receives oxygenated blood from lungs through pulmonary artery.
 - Left atrium transfers oxygenated blood to left ventricle which sends it to various parts of the body.
 - Right atrium receives deoxygenated blood through vena cava from upper and lower body.
 - Left atrium transfers oxygenated blood to aorta which sends it to different parts of the body.
 - (a) (C) (b) and (c)
 - (a) and (d) (D) (b) and (d)
- Select out of the following a gland which does NOT occur as a pair in the human body: 1
 - Pituitary (B) Ovary
 - Testis (D) Adrenal
- In human respiratory system, when a person breathes in, the position of ribs and diaphragm will be: 1
 - lifted ribs and curve/dome shaped diaphragm.
 - lifted ribs and flattened diaphragm.
 - relaxed ribs and flattened diaphragm.
 - relaxed ribs and curve/dome shaped diaphragm.

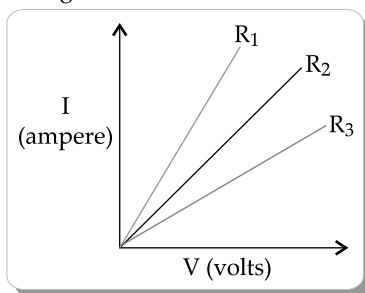
11. Identify the mode of asexual reproduction in the following organism: 1



- (A) Fragmentation
 (B) Multiple fission
 (C) Budding
 (D) Binary fission
12. A cross made between two pea plants produces 50% tall and 50% short pea plants. The gene combination of the parental pea plants must be 1
- (A) Tt and Tt (B) TT and Tt
 (C) Tt and tt (D) TT and tt
13. Consider the following statements in the context of human eye: 1
- (a) The diameter of the eye ball is about 2.3 cm.
 (b) Iris is a dark muscular diaphragm that controls the size of the pupil.
 (c) Most of the refraction for the light rays entering the eye occurs at the crystalline lens.
 (d) While focusing on the objects at different distances, the distance between the crystalline lens and the retina is adjusted by ciliary muscles.

The correct statements are

- (A) (a) and (b) (B) (a), (b) and (c)
 (C) (b), (c) and (d) (D) (a), (c) and (d)
14. The maximum resistance of a network of five identical resistors of $\frac{1}{5} \Omega$ each can be - 1
- (A) 1Ω (B) 0.5Ω
 (C) 0.25Ω (D) 0.1Ω
15. Study the I-V graph for three resistors of resistances R_1 , R_2 and R_3 and select the correct statement from the following: 1



- (A) $R_1 = R_2 = R_3$ (B) $R_1 > R_2 > R_3$
 (C) $R_3 > R_2 > R_1$ (D) $R_2 > R_3 > R_1$
16. Strength of magnetic field produced by a current carrying solenoid DOES NOT depend upon: 1
- (A) number of turns in the solenoid

- (B) direction of the current flowing through it
 (C) radius of solenoid
 (D) material of core of the solenoid

Q. Nos. 17 to 20 are Assertion – Reason based questions:

These questions consist of two statements - Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

- (A) Both (A) and (R) are true and (R) is the correct explanation of (A).
 (B) Both (A) and (R) are true, but (R) is not the correct explanation of (A).
 (C) (A) is true, but (R) is false.
 (D) (A) is false, but (R) is true.
17. **Assertion (A):** Different metals have different reactivities with water and dilute acids. 1
Reason (R): Extraction of a metal from its ore depends on its position in the reactivity series.
18. **Assertion (A):** Human female has a perfect pair of sex chromosome. 1
Reason (R): Sex chromosome contributed by the human male in the zygote decides the sex of a child.
19. **Assertion (A):** Myopic eye cannot see distant objects distinctly. 1
Reason (R): For the correction of myopia converging lenses of appropriate power are prescribed by eye-surgeons.
20. **Assertion (A):** The deflection of a compass needle placed near a current carrying wire decreases when the magnitude of an electric current in the wire is increased. 1
Reason (R): Strength of the magnetic field at a point due to a current carrying conductor increases on increasing the current in the conductor.

SECTION-B

Q. Nos. 21 to 26 are very short answer questions.

21. (A) "No precipitation reaction can occur without exchange of ions between the two reactants." Justify this statement giving a balanced chemical equation for the reaction. 2

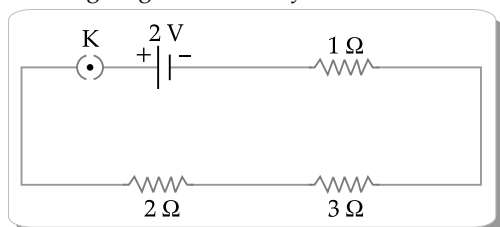
OR

- (B) Giving one example of each, differentiate between a displacement reaction and a double displacement reaction. 2
22. Photosynthesis takes place in the leaves and the food prepared by it reaches other parts of the plants. Name the process involved and explain 2
23. "Stability of DNA in a species is ensured during sexual reproduction." Justify the statement. 2
24. (A) State two laws of refraction of light. 2

OR

(B) Define the term absolute refractive index of a medium. A ray of light enters from vacuum to glass of absolute refractive index 1.5. Find the speed of light in glass. The speed of light in vacuum is 3×10^8 m/s. 2

25. Use Ohm's law to determine the potential difference across the 3Ω resistor in the circuit shown in the following diagram when key is closed: 2



26. Name the term used for the materials which cannot be broken down by biological processes. Give two ways by which they harm various components of an ecosystem. 2

SECTION-C

(Q. Nos. 27 to 33 are short answer questions.)

27. It is observed that Calcium on reaction with water floats on its surface. Explain why it happens. Also write a balanced chemical equation for the reaction that occurs. What happens when the aqueous solution of the product of this reaction reacts with Carbon dioxide gas? Write a balanced chemical equation for the reaction. 3
28. Draw a labelled diagram to show electrolytic refining of copper. State what happens when electric current is passed through the electrolyte taken in this case. 3
29. (a) Give reasons for the following: 3
- Alveoli in lungs are richly supplied with blood capillaries.
 - Respiratory pigment in the blood takes up oxygen and not carbon dioxide.
 - During anaerobic respiration, a 3-carbon molecule is formed as an end product instead of CO_2 in human beings.

OR

- (b) (i) Name the movements that occur all along the gut in human digestive system. How do they help in digestion? 3
- (ii) Where is bile juice stored in human body? List two roles of bile juice.
30. Explain the events that take place once a sperm reaches the oviduct till it becomes a foetus. Write the role of placenta in pregnancy. 3
31. (A) Define the term power of accommodation of human eye. Write the name of the part of eye which plays a major role in the process of accommodation and explain what happens

when human eye focuses (i) nearby objects and (ii) distant objects. 3

OR

- (B) Draw a ray diagram to show the formation of a rainbow in the sky. On this diagram mark A where dispersion of light occurs, B where internal reflection of light occurs and C where refraction of light occurs. List two necessary conditions to observe a rainbow. 3
32. Draw a diagram to show the pattern of magnetic field lines on a horizontal sheet of paper due to a straight conductor passing through its centre and carrying current vertically upwards. Mark on it (i) the direction of current in the conductor and (ii) the corresponding magnetic field lines. State right hand thumb rule and check whether the directions marked by you are in accordance with this rule or not. 3
33. Use of pesticides to protect our crops affect organisms at various trophic levels especially human beings. Name the phenomenon involved and explain how does it happen. 3

SECTION-D

Q. Nos. 34 to 36 are long answer questions.

34. (A) (i) Give reason why carbon can neither form C^{4+} cations nor C^{4-} anions but form covalent compounds. 5
- (ii) What is homologous series of carbon compound? Write the molecular formula of any two consecutive members of homologous series of aldehydes.
- (iii) Draw the structure of the molecule of cyclohexane (C_6H_{12}).

OR

- (B) (i) Name a commercially important carbon compound having functional group $-\text{OH}$ and write its molecular formula. 5
- (ii) Write chemical equation to show its reaction with
- Sodium metal
 - Excess conc. sulphuric acid
 - Ethanoic acid in the presence of an acid catalyst
 - Acidified potassium dichromate
- Also write the name of the product formed in each case.
35. (A) (i) Distinguish between hormonal co-ordination in plants and animals. 5
- (ii) Which part of the brain is responsible for -
- intelligence
 - riding a bicycle
 - vomiting
 - controlling hunger

- (iii) How is brain and spinal-cord protected against mechanical injuries?

OR

- (B) (i) What are tropic movements? Give an example of a plant hormone which (1) inhibits growth and (2) promotes cell division. 5
- (ii) Explain directional movement of a tendril in pea plant in response to touch. Name the hormone responsible for this movement.
36. (A) Upper half of a convex lens is covered with a black paper. Draw a ray diagram to show the formation of image of an object placed at a distance of $2F$ from such a lens. Mention the position and nature of the image formed. State the observable difference in the image obtained if the lens is uncovered. Give reason to justify your answer. 5
- (b) An object is placed at a distance of 30 cm from the optical centre of a concave lens of focal length 15 cm. Use lens formula to determine the distance of the image from the optical centre of the lens.

SECTION-E

Q. Nos. 37 to 39 are case based / data based questions with 2 to 3 short sub-parts. Internal choice is provided in one of these sub-parts.

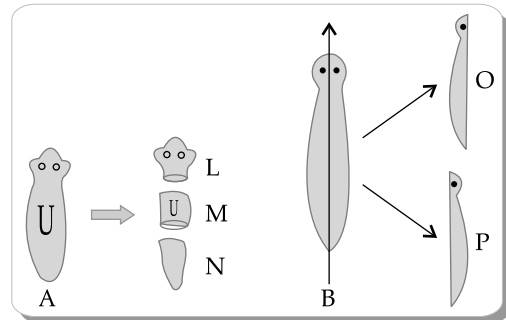
37. Salts play a very important role in our daily life. Sodium chloride which is known as common salt is used almost in every kitchen. Baking soda is also a salt used in faster cooking as well as in baking industry. The family of salts is classified on the basis of cations and anions present in them. 4
- (a) Identify the acid and base from which Sodium chloride is formed. 1
- (b) Find the cation and the anion present in Calcium sulphate. 1
- (c) "Sodium chloride and washing soda both belong to the same family of salts." Justify this statement. 2

OR

Define the term pH scale. Name the salt obtained by the reaction of Potassium hydroxide and Sulphuric acid and give the pH value of its aqueous solution. 2

38. Asexual reproduction involves a single parent to produce offsprings without the formation of gametes. It occurs by the following ways: Fission, Budding,

Fragmentation, Spore formation and Regeneration. In one of the methods like regeneration, *Planaria* A is cut horizontally into three pieces L, M and N and *Planaria* B is cut vertically into two equal halves - O and P. 4



- (a) Which of the cut pieces of the two *Planaria* could regenerate to form a complete organism? 1
- (b) Give an example of another organism which follows the same mode of reproduction as *Planaria*. 1
- (c) What is the meaning of 'development' in regeneration? 2

OR

- (c) Differentiate between regeneration and fragmentation. 2
39. When electric current flows in a purely resistive circuit electrical energy gets fully converted into heat energy. The amount of heat produced (H) in the circuit is found to be directly proportional to (i) the square of current (I^2) (ii) the resistance (R) of the conductor and (iii) the time (t) for which current flows. In other words $H = I^2Rt$. Electrical devices such as an electric fuse, electric heater, electric iron etc. are all based on this effect called heating effect of electric current. 4
- (a) List two properties of heating elements. 1
- (b) List two properties of electric fuse. 1
- (c) Name the principle on which an electric fuse works. Explain how a fuse wire is capable of saving electrical appliances from getting damaged due to accidentally produced high currents. 2

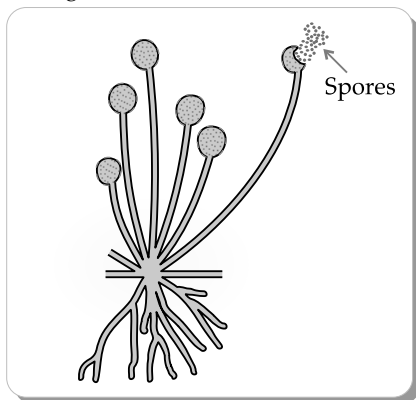
OR

The power of an electric heater is 1100 W. If the potential difference between the two terminals of the heater is 220 V, find the current flowing in the circuit. What will happen to an electric fuse of rating 5 A connected in this circuit? 2

Note: Except these, all questions are available in Outside Delhi Set-1.

SECTION-A

2. The number of shells required to write the electronic configuration of Potassium (At. No. 19) 1
 (A) 1 (B) 2
 (C) 3 (D) 4
5. Which of the following is an alloy of copper and tin? 1
 (A) Nichrome (B) Brass
 (C) Constantan (D) Bronze
6. Tooth decay begins at the pH of: 1
 (A) 5.1 (B) 5.8
 (C) 6.5 (D) 8.0
11. Which one of the following organism is represented by this diagram? 1



- (A) Spirogyra (B) Planaria
 (C) Yeast (D) Rhizopus
14. SI unit of electrical resistivity is 1
 (A) ohm per metre³ (B) ohm per metre
 (C) ohm. metre (D) ohm. metre³

Q. Nos. 17 to 20 are Assertion - Reason based questions:

20. **Assertion (A):** Metals in the middle of activity series are found in nature as sulphides or carbonates. 1
Reason (R): The sulphide ores are calcinated whereas carbonate ores are roasted to extract metals from them.

SECTION-B

Q. Nos. 21 to 26 are very short answer questions.

21. (A) Define a decomposition reaction. Write an equation to show thermal decomposition of ferrous sulphate crystals. 2

OR

- (B) What is meant by a balanced chemical equation? Why is it necessary for the equation to be balanced? 2
22. Two test tubes A and B are taken, each containing one mL of starch solution. Add 1 mL of saliva to test tube 'A' only and leave both the test tubes undisturbed for

a few minutes. Now add a few drops of dilute iodine solution to both the test tubes. 2

- (a) Which one of the two test tubes shows change in colour? Write the changed colour observed in this test tube.
- (b) What can we conclude from this activity?
23. Name two types of germ cells present in human beings. List two structural differences between the two. 2

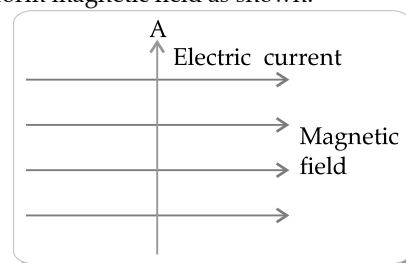
SECTION-C

Q. Nos. 27 to 33 are short answer questions.

28. (a) In angiosperms why fertilisation cannot take place in flowers if pollination does not take place? Where is zygote located in a flower after fertilisation? What does it develop into? 3
 (b) Write the names of those parts of a flower which serve the same function as the following do in animals:
 (i) testis (ii) ovary
29. (a) State any two observations when an electric current is passed through acidulated water, in a container having each electrode covered by test tubes filled with water. 3
 (b) Write the ratio of the mass of the gas collected at the cathode to the mass of the gas collected at the anode.
31. (A) An object is placed in front of a concave mirror of focal length 12 cm. If distance of the object from the pole of the mirror is 8 cm, then use mirror formula to determine the position of the image formed. Draw a labelled ray diagram to justify your answer in this case. 3

OR

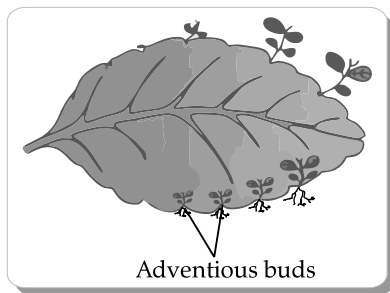
- (B) (i) The image of an object formed by a mirror is real, inverted and is of magnification-1. If the image is at a distance of 30 cm from the mirror, where is the object placed? Give reason to justify your answer. 3
 (ii) Where would the image be if the object is moved 15 cm towards the mirror? Draw ray diagram for the new position of the object to justify your answer.
32. State Fleming's left hand rule. Apply this rule to determine the direction of force experienced by a straight current carrying conductor AB placed in a uniform magnetic field as shown. 3



Note: Except these, all questions are available in Outside Delhi Set-1 and 2.

SECTION-A

- An iron nail is placed in a solution of copper sulphate. The nail is taken out after 15 minutes. The nail will be found to be covered with:
 - blue deposit
 - brown deposit
 - grey deposit
 - green deposit
- Which of the following reactions is an endothermic reaction?
 - Burning of coal
 - Decomposition of vegetable matter into compost
 - Process of respiration
 - Decomposition of calcium carbonate to form quick lime and carbon dioxide.
- In the given diagram the leaf shown belongs to which plant?



- Hibiscus
 - Money plant
 - Mustard
 - Bryophyllum
- The speed of light in vacuum is 3×10^8 m/s. If the speed of light in a medium is 2.25×10^8 m/s, the absolute refractive index of the medium is:
 - $\frac{7}{6}$
 - $\frac{5}{4}$
 - $\frac{4}{3}$
 - $\frac{3}{2}$
 - Study the following statements:
 - A fuse in a circuit prevents damage to the circuit due to overloading.
 - Total resistance in a circuit increases due to overloading.
 - During short circuiting the current in the circuit abruptly increases.
 - In order that each appliance has same current, they are connected in parallel to each other.

The correct statements are

- (a) and (b)
 - (b) and (d)
 - (a) and (c)
 - (a), (c) and (d)
- Assertion (A):** Carbon reduces the oxides of Sodium and Magnesium. **1**
Reason (R): Sodium and Magnesium have more affinity for Oxygen than Carbon.
 - Assertion (A):** The colour of clear sky appears blue. **1**
Reason (R): Light of blue colour has longer wavelength as compared to the light of red colour. So, it is scattered more in the upper atmosphere.

SECTION-B

- (a) Give one example of each of the following: **2**
 - Chemical reaction showing evolution of gas.
 - Change in the colour of the substance during a chemical reaction.

OR

- Translate the following statements into chemical equations and then balance them: **2**
 - Hydrogen sulphide gas burns in air to give water and sulphur dioxide.
 - Silver bromide on exposure to sunlight decomposes into silver and bromine.
- Name the blood vessel which brings blood to the kidneys. Why is nephron called a basic filtration unit of kidney? Write the role of tubular part of nephron in urine formation. **2**
- Mendel crossed a round and yellow seeded pea plant with a wrinkled and green seeded pea plant. What did the plants of F_1 generation look like in terms of shape and colour of seed? On self-pollinating F_1 generation plants, plants with four types of combinations of characters were seen in F_2 generation. Write the combinations along with their ratios. **2**
- (A) A person suffering from an eye defect uses lenses of power -1 D. Name the defect of vision and list its two causes. State the nature (converging / diverging) of the correcting lens. **2**

OR

- What is presbyopia? Name the type of lenses used for the correction of this defect. State the nature (converging / diverging) of the upper part of such lenses. **2**

SECTION-C

27. (a) Sodium metal is stored under kerosene oil, Why? 3
- (b) Some metal oxides are soluble in water. What are the aqueous solutions of these oxides called? Write one example of such a solution.
- (c) At ordinary temperature the surface of metals such as magnesium, aluminium, zinc etc. is covered with a thin layer. What is the composition of this layer? State its importance.
32. Define the term solenoid. Draw the pattern of magnetic field lines around a current carrying solenoid. State how this magnetic field can be used to magnetise a piece of magnetic material, like soft iron. 3



ANSWERS

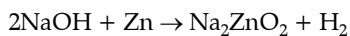
Delhi Set-1

31/1/1

SECTION - A

1. Option (B) is correct.

Explanation: The balanced chemical equation for the reaction between sodium hydroxide



This equation ensures that the number of atoms of each element is the same on both sides of the reaction.

2. Option (C) is correct.

Explanation: The decomposition reaction in which the source of energy for decomposition of light is typically referred to as a photochemical decomposition reaction. Among the options given, the reaction involving silver bromide ($2\text{AgBr} \rightarrow 2\text{Ag} + \text{Br}_2$) is a photochemical decomposition reaction.

3. Option (C) is correct.

Explanation: Mercury is the metal that exists as a liquid at room temperature, while bromine is the non-metal which exists as a liquid at room temperature.

4. Option (C) is correct.

Explanation: Carbon compounds are typically bad conductors of electricity because they consist of covalent bonds and electrons are not free to move. Carbon compounds usually have weak forces of attraction between their molecules due to the nature of covalent bonding.

5. Option (D) is correct.

Explanation: The compound with the maximum number of water molecules in its common crystalline form is $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$ (Hydrated sodium carbonate). This compound contains 10 water molecules per formula unit.

6. Option (C) is correct.

Explanation: Zinc and aluminium don't form acidic oxides but form amphoteric oxides.

7. Option (D) is correct.

Explanation: In MnO_2 , manganese (Mn) goes from an oxidation state of +4 to +2 in MnCl_2 . This means manganese is reduced. In HCl , chlorine (Cl) goes from an oxidation state of -1 to 0 in Cl_2 . This means chlorine is oxidised.

8. Option (B) is correct.

Explanation: The sex of a child is determined by the genetic contribution from both parents, but it's the father's sperm that carries either an X or a Y chromosome. During fertilisation, the fusion of the father's sperm (X or Y) with the mother's egg (always X) determines the child's sex.

9. Option (C) is correct.

Explanation: Chromosomes are vital cellular structures that fulfill key roles in heredity and cell division. They carry hereditary information from parents to offspring through their DNA content. These thread-like structures are located within the nucleus of animal cells. During cell division, chromosomes ensure the accurate distribution of genetic material, maintaining the integrity and transmission of genetic information across generations.

10. Option (A) is correct.

Explanation: The site where the electrical impulse is converted into a chemical signal is the axon terminal or synaptic bouton. The process involves the release of neurotransmitters from vesicles at the axon terminal into the synaptic cleft, which then bind to receptors on the adjacent neuron or target cell, initiating a chemical signal.

11. Option (D) is correct.

Explanation: Plants predominantly lose water through stomata and to mitigate excess water loss, they close stomata at night. However, stomata cannot remain closed during the day as plants need to intake carbon dioxide for photosynthesis. To ensure stomatal closure during the night, guard cells imbibe water, becoming turgid and closing the stomatal openings.

12. Option (C) is correct.

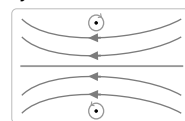
Explanation: To get an image of the same size as the object on a screen with a convex lens, the object should be placed at twice the focal length of the lens.

13. Option (D) is correct.

Explanation: The lens system of the human eye forms an image on the light-sensitive screen known as the retina.

14. Option (D) is correct.

Explanation: A solenoid is an electromagnet created by tightly winding a long wire into a helix. Each turn of the coil can be seen as a circular loop. When current flows through the solenoid, it generates a magnetic field. The direction of this magnetic field is determined by the right-hand thumb rule, providing a convenient way to ascertain its orientation.



15. Option (C) is correct.

Explanation: In option (C) "Tiger, grass, snake, frog," the second trophic level, which typically consists of herbivores consuming plants, is missing and that could be grasshopper. This breaks the usual structure of a food chain where energy is transferred from producers (plants) to consumers (herbivores) and then to higher-level consumers (carnivores or omnivores). The absence of herbivores in this chain disrupts the natural flow of energy through trophic levels.

16. Option (D) is correct.

Explanation: Multiple fission is a form of asexual reproduction, where a single parent cell divides into multiple daughter cells simultaneously. Plasmodium, which causes malaria, undergoes multiple fission during its life cycle. In the case of *Plasmodium*, the asexual reproduction involves the formation of multiple daughter cells (called merozoites) within a single parent cell (schizont). This process contributes to the rapid multiplication and spread of the parasite in the host's bloodstream.

17. Option (A) is correct.

Explanation: Hydrogen gas is not liberated in the reaction between a metal and nitric acid due to the powerful oxidising nature of nitric acid. Nitric acid serves as a robust oxidising agent, causing the hydrogen gas generated during the metal reaction to undergo oxidation, ultimately forming water. Consequently, no free hydrogen gas is observed in the process.

18. Option (B) is correct.

Explanation: The accumulation of harmful chemicals is indeed higher in organisms at the highest trophic levels due to the process of biomagnification, where toxins become more concentrated as they move up the food chain. The primary source of harmful chemicals in organisms at higher trophic levels is bioaccumulation from the consumption of contaminated prey, not necessarily from direct spraying on crops.

19. Option (C) is correct.

Explanation: Aquatic organisms, such as fishes, extract oxygen from water through their gills, where oxygen is dissolved. The concentration of dissolved oxygen in water is relatively low compared to atmospheric oxygen, necessitating a faster breathing rate in aquatic organisms compared to their terrestrial counterparts. This adaptation allows efficient extraction of the limited dissolved oxygen essential for their respiratory needs.

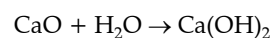
20. Option (A) is correct.

Explanation: The rainbow is a natural phenomenon that occurs when sunlight interacts with water droplets in the atmosphere. It is formed when the sun is shining and rain or water droplets are present

in the air. The sunlight is refracted, or bent, as it enters the water droplets, undergoes internal reflection and exits the droplets at various angles, creating a spectrum of colors that we observe as a beautiful arc in the sky.

SECTION - B

- 21.** The reaction between calcium oxide (CaO) and water is an example of a hydration reaction. The balanced chemical equation is:



This reaction involves the addition of water to calcium oxide, resulting in the formation of calcium hydroxide.

22. Roles in the Human Digestive System:

- (i) **Hydrochloric Acid:** Produced by the stomach lining, hydrochloric acid helps in the digestion of food, particularly proteins, by creating an acidic environment and activating digestive enzymes, pepsin.
 - (ii) **Villi:** These are tiny, finger-like projections in the small intestine that increase the surface area for nutrient absorption, allowing efficient absorption of digested food into the bloodstream.
 - (iii) **Anal Sphincter:** The anal sphincter is a muscular ring that regulates the release of feces from the rectum, maintaining control over bowel movements.
 - (iv) **Lipase:** Lipase is an enzyme that plays a crucial role in the digestion of fats. It breaks down triglycerides into fatty acids and glycerol for absorption.
- 23. (A)** The movement of leaves in a sensitive plant (*Mimosa pudica*) is different from the downward movement of roots. The leaves exhibit thigmonastic movement, responding to touch or mechanical stimulation. When touched, the leaflets fold inward and droop, a defensive mechanism to deter herbivores. In contrast, the downward movement of roots, known as geotropism, is a positive response to gravity, allowing the roots to grow in the direction of gravitational pull, aiding in anchorage and nutrient absorption.

OR

- (B) The hormone that regulates carbohydrate, protein and fat metabolism in our body is insulin. Insulin is produced by the pancreas. As for the importance of iodised salt in our diet, it is due to the role of iodine in the synthesis of thyroid hormones. The thyroid gland requires iodine to produce hormones such as thyroxine (T₄) and Triiodothyronine (T₃), which are essential for the proper functioning of the thyroid gland.

Adequate iodine intake helps prevent iodine deficiency disorders and ensures the normal functioning of the thyroid, contributing to overall metabolic regulation and growth.

24. To find the position of the image formed by a convex mirror, we can use the mirror formula:

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

where:

- f is the focal length of the mirror,
- u is the object distance (distance of the object from the mirror) and
- v is the image distance (distance of the image from the mirror).

Given that $f = 15$ cm and $u = -10$ cm (because the object is placed in front of the mirror), we can rearrange the formula to solve for v :

$$\begin{aligned} \frac{1}{v} &= \frac{1}{f} - \frac{1}{u} \\ \frac{1}{v} &= \frac{1}{15} - \frac{1}{-10} \\ \frac{1}{v} &= \frac{2}{30} + \frac{3}{30} \end{aligned}$$

$$v = 6 \text{ cm}$$

The positive value for v indicates that the image is formed on the same side as the object (in front of the mirror), which is typical for convex mirrors.

Therefore, the position of the image formed by the convex mirror is 6 cm in front of the mirror.

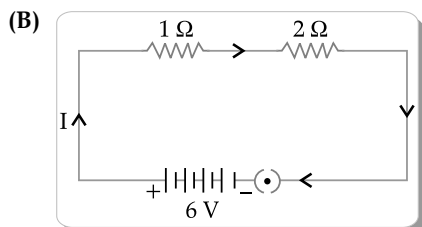
25. (A)

- (i) First, we connect two resistors each of 6Ω in parallel connection

$$\text{then, } \frac{1}{R} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$$

$$R = 3 \Omega$$

If 3rd resistor of 6Ω and 3Ω are connected in series, then the resultant resistance = $6\Omega + 3\Omega = 9\Omega$



$$\text{Total Resistance} = 1\Omega + 2\Omega = 3\Omega$$

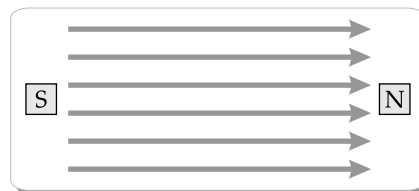
$$\text{Total applied voltage}(V) = 6V$$

$$\text{Circuit Current } (I) = \frac{V}{R} = \frac{6V}{3\Omega} = 2A$$

$$\text{Power Consumed across 2 ohm resistor} = I^2R = 2^2 \times 2 = 8W$$

26. (i) Magnetic field lines do not intersect each other because if they did, it would imply the existence of two different directions of the magnetic field at the same point, which is not physically meaningful. The basic principle is that a magnetic field line represents the direction of the magnetic force experienced by a hypothetical north pole placed at that point. If two field lines were to intersect, it would suggest conflicting directions for the magnetic force at the intersection point, violating the rules of a well-defined magnetic field. The non-intersection of magnetic field lines is a fundamental property of magnetic fields and is consistent with the nature of magnetic interactions.

- (ii) A uniform magnetic field in a given region is represented by straight and parallel magnetic field lines. These field lines indicate that the magnetic field has the same strength and direction throughout the entire region. Here is a simple diagram illustrating a uniform magnetic field:

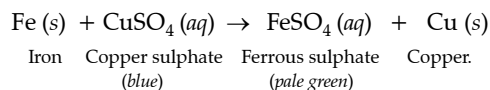


In this representation, the arrows indicate the direction of the magnetic field and the fact that they are straight and parallel suggests uniformity. The spacing between the lines represents the strength of the magnetic field, with closer lines indicating a stronger field. In a truly uniform magnetic field, the spacing between the lines would be consistent throughout the region.

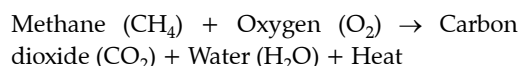
SECTION - C

27. (i) **Change in Colour:**

Reaction between iron and copper sulphate results in changing the blue colour of copper sulphate to a pale green.



- (ii) **Change in Temperature:**



The combustion of methane with oxygen releases heat energy, causing a rise in temperature.

- (iii) **Formation of Precipitate:**

Lead Nitrate ($\text{Pb(NO}_3\text{)}_2$) + Potassium Iodide (KI) \rightarrow Lead Iodide (PbI_2) + Potassium Nitrate (KNO_3) \downarrow In this reaction, lead iodide (PbI_2) is formed as a yellow precipitate, indicating a change in colour and the formation of a solid.

28. (i) The pH of tomato juice is 4.6, which classifies it as slightly acidic. The taste of the juice is likely to be tangy or slightly sour. This is because acidic substances generally have a sour taste and the pH value of 4.6 indicates a mild acidity.
- (ii) Differentiating between a strong acid and a weak base can be done by observing the ions formed in aqueous solutions. Strong acids ionize completely in water, forming a high concentration of hydrogen ions (H^+), while weak bases partially ionise, leading to a lower concentration of hydroxide ions (OH^-). The distinguishing factor lies in the type and extent of ionisation.
- (iii) Acid rain, formed by the release of sulfur dioxide ($2SO_2$) and nitrogen oxides (NO_x) into the atmosphere, can lower the pH of precipitation. When acid rain falls into aquatic ecosystems, it increases the acidity of water bodies. This acidification poses a threat to aquatic life by affecting the pH balance essential for the survival of many species. It can harm fish, amphibians and other aquatic organisms, impacting their reproductive, feeding and respiratory processes.
29. (i) Respiratory pigments, like haemoglobin, are crucial for large multicellular organisms as they enhance oxygen transport, ensuring efficient delivery to cells with high metabolic demands. Pigments increase oxygen-carrying capacity, overcome diffusion limitations and act as reservoirs, stabilising oxygen supply during varying metabolic activities.
- (ii) (a) **Rings of Cartilage in the Throat:**
- **Reason:** To prevent the collapse of the airway. The cartilaginous rings provide structural support to the trachea and bronchi, ensuring that the airway remains open and allows the smooth passage of air during breathing.
- (b) **Lungs Always Contain a Residual Volume of Air:**
- **Reason:** To maintain gas exchange efficiency. The residual volume ensures a constant supply of oxygen to the blood even between breaths, preventing alveoli from collapsing completely. This helps maintain a baseline oxygen level and facilitates continuous diffusion of gases.
- (c) **Diaphragm Flattens and Ribs Lifted Up When We Breathe:**
- **Reason:** To increase thoracic volume and decrease pressure. Flattening of the diaphragm and lifting of the ribs expand the thoracic cavity, reducing air

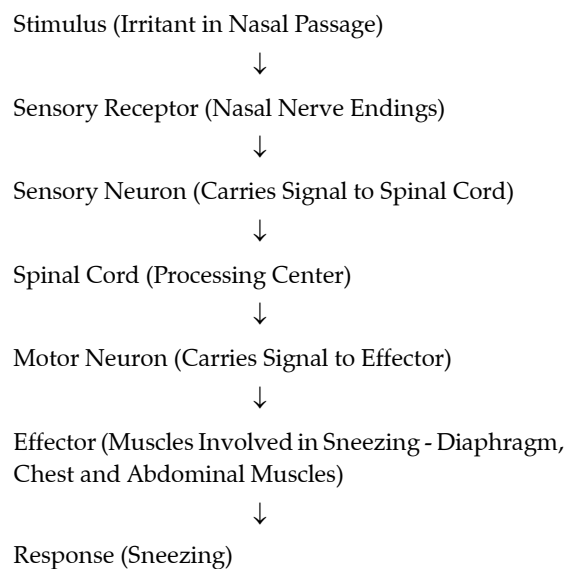
pressure within the lungs. This pressure change causes air to flow into the lungs, allowing inhalation to occur.

(d) Walls of Alveoli Contain an Extensive Network of Blood Vessels:

- **Reason:** To facilitate efficient gas exchange, walls of alveoli contain extensive network of blood vessels. The close proximity of the alveolar walls to the extensive network of blood vessels (capillaries) allows for the rapid exchange of oxygen and carbon dioxide during respiration. This proximity ensures effective diffusion of gases across the respiratory membrane.

30. **Reflex Action:** A reflex action is an involuntary and rapid response to a stimulus that occurs without conscious thought. It is a protective mechanism designed to minimize potential harm to the body by eliciting a quick and automatic response.

Path of a Reflex Action - Sneezing:



Stimulus: Presence of an irritant in the nasal passage.

Sensory Receptor: Nasal nerve endings detect the irritant.

Sensory Neuron: Carries the sensory signal to the spinal cord.

Spinal Cord: Acts as the processing center for the reflex action.

Motor Neuron: Carries the processed signal from the spinal cord to the effector.

Effector: Muscles involved in the sneezing reflex, including the diaphragm, chest and abdominal muscles.

Response: Sneezing occurs as a rapid and involuntary expulsion of air to clear the irritant from the nasal passage.

31. (i) Hypermetropia, commonly known as far-sightedness, is a refractive error in the eye where distant objects are seen more clearly than nearby ones. In this condition, the eyeball is too short, or the cornea has insufficient curvature, causing the light entering the eye to focus behind the retina instead of directly on it.

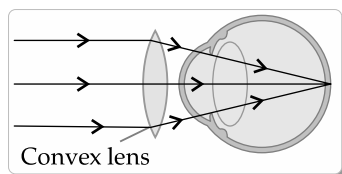
Individuals with hypermetropia can perceive distant objects without difficulty but struggle with close-range vision. The near point for a hypermetropic person is situated farther from the eye than the normal near point of 25 cm. Consequently, for comfortable reading, they need to hold reading materials at a distance greater than 25 cm.

This visual anomaly occurs because the light rays from nearby objects converge behind the retina rather than directly on it. To compensate, a hypermetropic person positions reading material farther away, allowing the light to converge appropriately and form a clear image on the retina, thereby facilitating comfortable reading.

- (ii) **Two causes of the defects are:**

- the focal length of the eye lens is too long.
- the eyeball has become too small.

- (iii) Defect of vision is corrected by using convex lens as shown below.



32. (i) **Name of the Rule:**

The rule that determines the direction of the magnetic field produced around a current-carrying straight conductor is known as the Right-Hand Thumb Rule.

Statement of the Rule:

When the right-hand thumb rule is applied to a straight current-carrying conductor:

If the thumb points in the direction of the current (the flow of positive charge),

The curled fingers around the conductor represent the direction of the magnetic field.

In summary, when the thumb points along the current, the fingers curl in the direction of the magnetic field lines around the conductor. This rule helps establish the relationship between the current direction and the magnetic field direction in a straight conductor.

- (ii) The rule to determine the direction of the force experienced by a current-carrying straight conductor placed in a magnetic field, which is perpendicular to it, is known as the **Fleming's Left-Hand Rule**.

Statement of the Rule: When using Fleming's Left-Hand Rule:

- The thumb represents the direction of the force (F).
- The index finger represents the direction of the magnetic field (B).
- The middle finger represents the direction of the current (I).

By aligning these three directions according to the rule, the force direction on the conductor can be determined. The rule is applicable when the magnetic field, current and force are mutually perpendicular to each other.

33. (A) In the given food chain "Plants → Deer → Lion," if all the organisms of the second trophic level (Deer) are removed, the impact on the first and third trophic levels would be as follows:

1. **Impact on the First Trophic Level (Plants):**

- The removal of all Deer would lead to an increase in the population of Plants because there would be fewer herbivores to consume them. The Deer population controls the consumption of Plants, so their removal allows Plants to thrive.

2. **Impact on the Third Trophic Level (Lion):**

- With the removal of all Deer, the population of Lions would be adversely affected. Lions are predators at the third trophic level and their primary food source is Deer. Without Deer, Lions would face a decline in their prey, potentially leading to a decrease in their population.

3. **If Present in a Food Web:**

- In a food web, the impact on the organisms of the third trophic level (Lion) would depend on the complexity of the interactions. If Lions have alternative prey or multiple pathways for obtaining food, their population may not be as severely impacted. Food webs often involve multiple interconnected species, allowing for greater flexibility in resource availability.

- (B) X is Ozone.

Ozone: Ozone (O_3) is a molecule composed of three oxygen atoms. It exists in the Earth's stratosphere and plays a crucial role in the atmosphere.

Functions of Ozone:

- 1. Ultraviolet (UV) Radiation Absorption:** Ozone absorbs the majority of the sun's harmful ultraviolet (UV) radiation in the stratosphere, preventing it from reaching the Earth's surface and protecting life from the adverse effects of UV rays.
- 2. Temperature Regulation:** Ozone contributes to temperature regulation in the stratosphere by absorbing solar energy, leading to the warming of the stratosphere.

Depletion of Ozone: Human activities, particularly the release of chlorofluorocarbons (CFCs), halons and other ozone-depleting substances (ODS), have led to the destruction of ozone molecules in the stratosphere. The release of these substances has resulted in the formation of ozone-depleting compounds, which break down ozone molecules and reduce the concentration of ozone in the stratosphere.

International Organisation to Check Ozone Depletion: The primary international organisation dedicated to addressing ozone depletion is the Montreal Protocol on Substances that Deplete the Ozone Layer adopted in 1987, the Montreal Protocol is an international treaty designed to phase out the production and consumption of ODS, such as CFCs and halons. It has been successful in reducing the emissions of ODS, contributing significantly to the recovery of the ozone layer.

The Ozone Secretariat, part of the United Nations Environment Programme (UNEP), oversees the implementation of the Montreal Protocol and provides support to countries in their efforts to eliminate ODS. The protocol is a testament to global cooperation in addressing environmental challenges.

SECTION - D

- 34. (A) (i)** A homologous series of carbon compounds is a group of organic compounds sharing a common functional group and exhibiting a consistent structural pattern. Members in the series have similar chemical properties, a constant chemical increment (usually CH_2) and gradual increases in molecular size and complexity. Examples include alkanes, alkenes and alkynes.
- (ii)** The melting point and boiling point of C_4H_8 (butene) is higher than C_3H_6 (propene) or C_2H_4 (ethene) due to stronger intermolecular forces in butene, resulting from the presence of a double bond, stronger dipole-dipole interactions and

longer chain length than propene and ethene.

- (iii)** Chemical properties within a homologous series remain consistent due to the presence of a common functional group. This shared characteristic imparts similar chemical behaviour to all members, leading to a lack of gradation in chemical properties. The influence of the functional group dominates, overshadowing gradual increases in molecular size and ensuring uniformity across the series.

(iv) (i) Aldehyde:

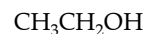
- **Name:** Propanal
- **Structure:** $\text{CH}_3\text{CH}_2\text{CHO}$

(ii) Ketone:

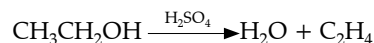
- **Name:** Propanone (also known as acetone)
- **Structure:** CH_3COCH_3

OR

- (B) (i)** The organic compound "X" with two carbon atoms and suffixed with '-ol' is ethyl alcohol. Its chemical structure is:



- (ii)** When ethyl alcohol (X) is heated with excess concentrated sulfuric acid (H_2SO_4) at 443 K, it undergoes dehydration to form ethylene gas (C_2H_4). The chemical equation for the reaction is:



The concentrated sulfuric acid acts as a dehydrating agent, removing water (H_2O) from the alcohol molecule and promoting the elimination of a hydroxyl group ($-\text{OH}$) and a hydrogen atom (H) to form water. This leads to the formation of ethylene gas.

- (iii)** The electron dot structure of ethylene (C_2H_4) can be represented as follows:



In this structure, each carbon atom forms a double bond with the other carbon atom and each carbon is bonded to two hydrogen atoms. The dots represent the valence electrons and the lines represent the bonds between atoms.

35. (A) (i) Contraceptive Pills:

- **Side Effects:**
 - Nausea
 - Weight gain or loss
 - Changes in mood
 - Headaches
 - Irregular bleeding
 - Breast tenderness

(ii) **Intrauterine Device (IUD):**

• **Side Effects:**

- Cramping or pain during insertion
- Increased menstrual bleeding and cramps
- Expulsion of the device
- Perforation of the uterus (rare)

3. **Barrier Methods (e.g., Condoms):**

• **Side Effects:**

- Allergic reactions to latex (for latex condoms)
- Reduced sensitivity during intercourse
- Possible breakage or slippage, leading to contraceptive failure

(ii) (a) **If Fertilisation takes place:** If fertilisation occurs in a human female's reproductive system, the fertilised egg (zygote) undergoes multiple divisions and forms a blastocyst. This blastocyst then travels down and reaches to the uterus and get implanted there.

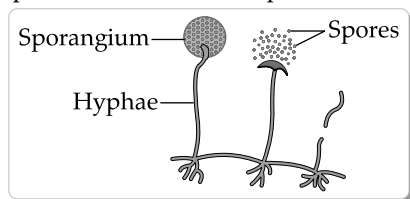
(b) **If the egg is not Fertilised:**

If the egg is not fertilised, the following events occur:

- The corpus luteum, which is formed from the ovarian follicle after the release of the egg, degenerates.
- Hormone levels (progesterone and estrogen) drop.
- The thickened uterine lining is shed during menstruation.

OR

B. (i) Spore formation in Rhizopus

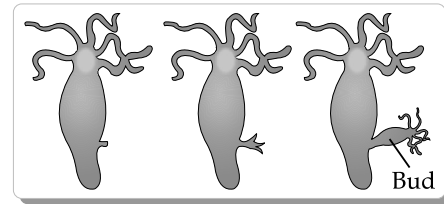


(a) Reproductive parts of bread mould (Rhizopus) – Sporangium (b) Non-reproductive parts of bread mould (Rhizopus) is Hyphae.

Rhizopus, being a fungus, requires moisture for growth and multiplication. It does not multiply on a dry slice of bread because the dry environment inhibits its hyphal growth and nutrient absorption.

(ii) Hydra typically undergoes asexual reproduction through a process known as budding. This involves the formation of a bud on the tubular body of an adult Hydra, which then develops its own mouth and tentacles. Subsequently, the newly formed bud detaches from the parent Hydra, becoming an independent, fully

developed organism. The offspring Hydra then locates its own attachment site.



36. (A) (i) Electric power (P) is the rate at which electrical energy is transferred or consumed in an electrical circuit. It can be represented by the formula:

$$P = IV$$

where:

- P is the electric power in watts (W),
- I is the current in amperes (A) and
- V is the potential difference (voltage) in volts (V).

Additionally, the relationship between electric power, potential difference and resistance (R) can be expressed using Ohm's Law, which states:

$$P = RV^2$$

or

$$P = I^2R$$

These formulas provide different ways to calculate electric power in a circuit based on the given values of current, voltage and resistance.

(ii) (a) **Power rating (P):** The formula for power (P) is

$$P = \frac{E}{t}$$

where E is the energy consumed and t is the time.

$$P = \frac{11 \text{ units}}{5 \text{ hours}} = \frac{2.2 \text{ units}}{\text{hours}}$$

This result is the power rating of the oven.

(b) **Current drawn (I):** The formula relating power, current and voltage is $P=IV$. We can rearrange it

$$\text{to find the current: } I = \frac{P}{V}$$

$$I = \frac{2.2}{220} = 0.01 \text{ ampere}$$

Therefore, the current drawn by the oven is 0.01 Amperes.

(c) **Resistance (R) when the oven is hot:** The relationship between power, current and resistance is $P = I^2R$. We can rearrange it to find the resistance:

$$R = \frac{2.2}{0.01^2}$$

$$R = 220\Omega$$

Hence, the resistance of the oven when it is hot is 220 ohms.

OR

- (B) (i) Relation between Resistance (R) and Electrical Resistivity (ρ): The resistance (R) of a conductor is directly proportional to its length (L) and inversely proportional to the cross-sectional area (A). The relationship is given by:

$$R = \frac{\rho L}{A}$$

where:

- R is the resistance,
- ρ is the electrical resistivity,
- L is the length of the conductor and
- A is the cross-sectional area of the conductor.

Derivation of the SI Unit of Electrical Resistivity: The SI unit of resistance (R) is the ohm (Ω), the unit of length (L) is the meter (m) and the unit of cross-sectional area (A) is square meters (m^2).

$$1 \Omega = \Omega m / m^2$$

So, the SI unit of electrical resistivity (ρ) is ohm meter ($\Omega \cdot m$).

- (ii) **Calculation of Electrical Resistivity:** Given that $R = 60 \Omega$, $L = 3 \text{ m}$ and $A = 4 \times 10^{-6} \text{ m}^2$, we can rearrange the formula from part (i) to solve for electrical resistivity (ρ):

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

$$\rho = (60 \Omega) \cdot (4 \times 10^{-6} \text{ m}^2) / 3 \text{ m}$$

$$\rho \approx 8 \times 10^{-5} \Omega \cdot m$$

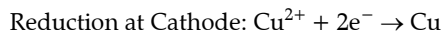
- (iii) **Effect of Stretching on Electrical Resistivity:** If the wire is stretched so that its length is doubled, the electrical resistivity (ρ) remains constant. The electrical resistivity of a material is an intrinsic property that depends on the material itself and is not affected by changes in the dimensions (length, cross-sectional area) of the conductor. Therefore, doubling the length of the wire will not alter its electrical resistivity.

SECTION - E

37. (i) In the electrolytic refining of copper, the cathode is made of the impure copper that needs to be refined and the anode is made of a pure copper sheet. During the electrolysis process, copper from the impure cathode is deposited on the pure copper anode.
- (ii) The solution used in the electrolytic refining of copper is typically copper sulfate (CuSO_4) solution.

- (iii) (A) In the electrolytic cell, when electric current is passed, copper ions (Cu^{2+}) from the copper sulfate solution migrate towards the cathode (impure copper). At the cathode, each copper ion gains two electrons and is reduced to form solid copper (Cu) which gets deposited on the cathode. The impurities present in the original copper anode settle at the bottom of the electrolytic cell as anode mud or sludge.

The overall reaction at the cathode is:



At the anode, copper from the anode is oxidised to copper ions:



The net result is the transfer of copper from the impure cathode to the pure anode, leading to the purification of copper in the electrolytic cell.

(B) Beaker A (with zinc strip):

- **Observation:** The zinc strip in beaker 'A' will show signs of corrosion and the colour of the solution will change.
- **Reason:** Zinc is more reactive than copper. When a strip of zinc is dipped into a copper sulfate solution, a displacement reaction occurs. The zinc undergoes oxidation and copper ions in the solution are reduced to form solid copper. The reaction can be represented as: $\text{Zn(s)} + \text{CuSO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu(s)}$
- The solid copper will either settle at the bottom or get deposited on the zinc strip and the colour of the solution will turn blue due to the presence of copper ions.

2. Beaker B (with silver strip):

- **Observation:** There will be no significant change in the appearance of the silver strip and the colour of the solution will remain unchanged.
- **Reason:** Silver is less reactive than copper. Therefore, there won't be a displacement reaction between silver and copper sulfate solution. Silver does not readily react with copper sulfate and hence, there will be no observable reaction or change in the appearance of the silver strip or the solution.

38. (i) When Mendel crossed pea plants with pure tall (dominant) and pure short (recessive) characteristics to produce F_1 progeny, two observations were made:
- (a) **All F_1 plants were tall:** In the first generation (F_1), all the plants exhibited the tall trait and the short trait seemed to disappear.
- (b) **Short trait reappeared in F_2 :** In the second generation (F_2), the short trait reappeared and there was a 3:1 ratio of tall to short plants.

(ii) Difference between Dominant and Recessive Traits:

- **Dominant Trait:** It is the trait that expresses itself and masks the effect of the recessive trait in a heterozygous individual. Dominant traits are represented by capital letters (e.g., T).
- **Recessive Trait:** It is the trait that is expressed only in the homozygous condition and remains hidden in the presence of a dominant allele. Recessive traits are represented by lowercase letters (e.g., t).

(iii) (A) Mendel obtained the F₁ generation through a dihybrid cross. In this cross, he considered two pairs of contrasting characters: one for seed shape (round or wrinkled) and another for seed color (yellow or green).

The parental genotypes were:

- RRYy (Round Yellow) for one parent
- rryy (Wrinkled Green) for the other parent

We can explain it by taking an example

Cross between → RrYy × RrYy

RR-Round yy - green

Rr-round Yy green

rr - Wrinkled yy - yellow

Cross →

	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

(Phenotypic ratio) → 9: 3: 3: 1

Genotypic ratio → 1: 2: 2: 1: 4: 2: 1: 2: 1

Conclusions drawn from this experiment:

- 1. Law of Independent Assortment:** Mendel concluded that alleles of different traits segregate independently during the formation of gametes. The inheritance of seed shape (round or wrinkled) is independent of the inheritance of seed color (yellow or green).
 - 2. Dihybrid Ratio:** The phenotypic ratio of 9: 3: 3: 1 observed in the F₂ generation supports the Law of Independent Assortment. This is the dihybrid ratio, which represents the distribution of different combinations of traits when two pairs of contrasting characters are considered in a genetic cross.
- (iii) (B)** The statement "It is possible that a trait is inherited but may not be expressed" is justified by the concepts of dominant and recessive alleles

in genetics. In many cases, an individual inherits two alleles for a particular trait, one from each parent. These alleles may be either identical (homozygous) or different (heterozygous). The interaction between these alleles determines whether the trait is expressed in the phenotype.

1. Dominant Allele:

- If an individual inherits at least one dominant allele for a particular trait, the dominant allele will be expressed in the phenotype.
- Dominant alleles are usually represented by uppercase letters (e.g., T).

2. Recessive Allele:

- For a recessive trait to be expressed, an individual must inherit two recessive alleles (homozygous recessive).
- Recessive alleles are typically represented by lowercase letters (e.g., t).

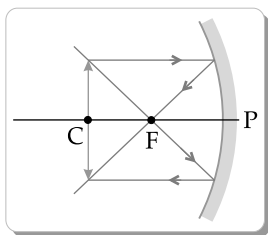
3. Heterozygous Individuals:

- If an individual is heterozygous for a particular trait (has one dominant and one recessive allele), the dominant allele will mask the expression of the recessive allele and the trait associated with the recessive allele will not be expressed in the phenotype.
- The individual is a carrier of the recessive trait but does not show it.

This phenomenon demonstrates that the presence of a particular allele in an individual's genotype does not always result in the expression of the corresponding trait. The expression of a trait depends on the interaction between the alleles inherited and follows the principles of Mendelian genetics.

- 39. (i)** (In Case 1, where Mirror A has a focal length of 20 cm and an object distance of 45 cm, the mirror will form a diminished image of the object. This is because the object distance (u) is greater than twice the focal length (2f). According to the mirror formula $1/f = 1/u + 1/v$, when $u > 2f$, the image formed is diminished.
- (ii)** Two properties of the image formed in Case 2 (Mirror B with a focal length of 15 cm and an object distance of 30 cm) are:
- The **image is formed** beyond 2f (twice the focal length).
 - The **image is real**.
- (iii) (A) Nature of the Image:** The image will be real, inverted and formed between the focal point and the mirror's surface.

Size of the Image: Since the object distance is less than the focal length but greater than half of it, the image will be magnified.



- (iii) (B) To find the position of the image formed by a concave mirror, you can use the mirror formula:

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

where:

- f is the focal length of the concave mirror,

- u is the object distance (distance of the object from the mirror),
- v is the image distance (distance of the image from the mirror).

Given: $f = -12$ cm (negative because it's a concave mirror), $u = -18$ cm (negative because the object is placed in front of the mirror).

Substitute the values into the formula:

$$v = 36$$

So, the image is formed at a distance of 36 cm from the pole of the concave mirror. The positive sign indicates that the image is formed on the same side as the incident light (in front of the mirror).

Delhi Set-2

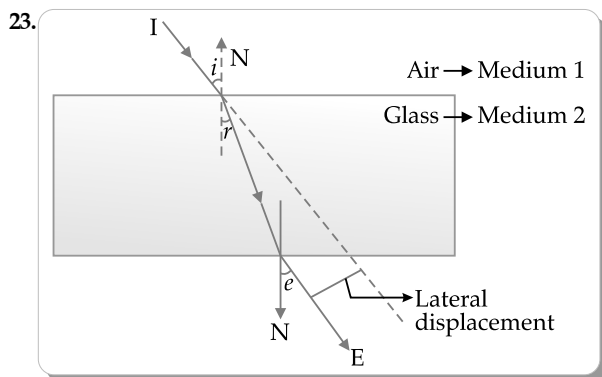
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SECTION - A

4. Option (C) is correct.

Explanation: In the nomenclature of organic compounds, alkynes are hydrocarbons containing triple bonds between carbon atoms. Butyne is specifically an alkyne with four carbon atoms in its chain and a triple bond between the second and third carbon atoms.

SECTION - B



24. (A) (i) **Medulla Oblongata:**

- Location:** The medulla oblongata is located in the hindbrain, at the base of the brainstem.
- Function:** It plays a crucial role in regulating vital involuntary functions such as heartbeat, breathing, blood pressure and reflex actions like swallowing and vomiting.

- (ii) **Cerebrum:**

- Location:** The cerebrum is the largest part of the brain and is situated at the topmost part of the central nervous system.
- Function:** The cerebrum is primarily responsible for higher cognitive functions, including thinking, memory, perception and voluntary

motor movements. It is also involved in processing sensory information and controlling conscious awareness.

OR

- (B) The hormone that promotes the growth of tendrils in plants is auxin. Auxin is a plant hormone that plays a key role in various aspects of plant growth and development, including the elongation of cells.

Tendrils are slender, specialised structures that help climbing plants like peas to attach to and climb up other surfaces. Here's how auxin and tendrils work together:

- Auxin Production:** The growing tip of the tendril produces auxin, which is then transported downwards.
- Unequal Growth:** Auxin promotes cell elongation, causing the cells on the side of the tendril opposite to the support to elongate more than the cells on the side touching the support.
- Curling Response:** As a result of unequal growth, the tendril undergoes a curling response. The side with more elongated cells grows faster, causing the tendril to curl around the support.
- Attachment:** The curled tendrils now wrap around the support, providing a means for the climbing plant to anchor itself and support its growth.

25. The pathway of urine in our body starts from the organ of its formation, the kidneys and ends with its excretion. Here's the pathway:

- Kidneys:** Urine formation begins in the kidneys, which are the primary organs responsible for filtering blood and removing waste products.

Each kidney contains numerous nephrons, which are the functional units responsible for urine production.

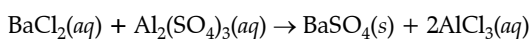
2. **Renal Tubules:** Within the nephrons, urine formation involves several stages in the renal tubules, including filtration, reabsorption and secretion.
3. **Renal Pelvis:** The formed urine is then collected in the renal pelvis, a funnel-shaped structure in the kidney that serves as a reservoir.
4. **Ureters:** From the renal pelvis, urine travels through the ureters, which are muscular tubes connecting the kidneys to the urinary bladder. Peristaltic contractions of the ureter walls help propel urine toward the bladder.
5. **Urinary Bladder:** Urine is temporarily stored in the urinary bladder until it is ready for elimination. The bladder is a muscular organ that expands as it fills with urine.
6. **Urethra:** The final part of the pathway is the urethra, a tube that carries urine from the bladder to the outside of the body during the process of micturition or urination.

If the tubular part of the nephron does not work properly, it can lead to various issues, including:

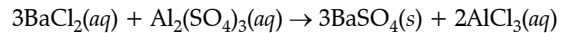
- **Reduced Filtration:** Impaired tubular function may result in decreased filtration of waste products from the blood, leading to the retention of toxins in the body.
- **Electrolyte Imbalance:** The tubules play a crucial role in maintaining the balance of electrolytes (such as sodium, potassium and calcium) in the body. Dysfunction can disrupt this balance.
- **Fluid Imbalance:** Proper tubular function is essential for regulating the body's fluid balance. Impairment may lead to problems like edema or dehydration.
- **Acid-Base Imbalance:** The nephron tubules are involved in maintaining the body's acid-base balance. Malfunction can result in acidosis or alkalosis.
- **Excretion Issues:** If the tubules are not functioning properly, the excretion of waste products and excess substances may be compromised.

Overall, the tubular part of the nephron is critical for maintaining homeostasis in the body and dysfunction can lead to various health problems.

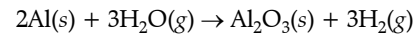
26. (i) The chemical equation for the reaction between barium chloride (BaCl_2) and aluminum sulfate ($\text{Al}_2(\text{SO}_4)_3$) in water is:



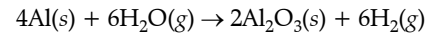
To balance the equation, you need to ensure that the number of each type of atom is the same on both sides of the equation. The balanced equation is:



- (ii) The chemical equation for the reaction between aluminum metal (Al) and steam (H_2O) to form aluminum oxide (Al_2O_3) and hydrogen gas (H_2) is:



The balanced equation is:



These balanced chemical equations represent the reactions described in the given statements.

SECTION-C

30. (i) **Variiegated Leaves:**

- Variiegated leaves are leaves that have more than one colour on them. These leaves typically display a combination of green and white, yellow or other pigments.
- **Example:** The Coleus plant has variiegated leaves. The variations in color result from differences in chlorophyll content or the presence of other pigments.

- (ii) **Boiling Leaf in Alcohol:**

- When a leaf is boiled in alcohol, chlorophyll is extracted from the leaf. As a result, the colour of the leaf fades and the alcohol solution takes on the green colour of chlorophyll.

- (iii) **Carbohydrate Storage in Plants:**

- The carbohydrate produced during photosynthesis is primarily stored in the form of starch in plant cells, particularly in storage organs like roots, tubers and seeds.

Why Chlorophyll is Necessary for Photosynthesis:

- Chlorophyll is a pigment that plays a crucial role in photosynthesis. It absorbs light energy from the sun and facilitates the conversion of carbon dioxide and water into glucose (carbohydrate) and oxygen.
- The chlorophyll molecule is involved in the photochemical reactions that occur in the thylakoid membranes of chloroplasts during the light-dependent phase of photosynthesis.
- Without chlorophyll, plants cannot capture and harness light energy effectively, resulting in the inability to carry out photosynthesis. This process is vital for the synthesis of organic compounds that serve as energy sources for the plant and, in turn, for other organisms in the food chain.

32. A beam of white light gives a spectrum of seven colours on passing through a solid prism. This splitting up of white light into its constituent colours is known as dispersion of light.

The second law of refraction, also known as Snell's Law, states that the refractive index (n) is inversely proportional to the speed of light in a medium. Mathematically, Snell's Law is given by:

$$n_1 \sin(\theta_1) = n_2 \sin(\theta_2)$$

where:

- n_1 and n_2 are the refractive indices of the two media,
- θ_1 and θ_2 are the angles of incidence and refraction, respectively.

The speed of light in a medium is inversely proportional to its refractive index. Therefore, the color of light with the highest refractive index will be the one that undergoes the most significant decrease in speed when entering a denser medium.

Among the seven visible colors of light, violet light has the shortest wavelength. According to the relationship between wavelength and refractive index, shorter wavelengths are more significantly refracted than longer wavelengths. Therefore, violet light must have the highest refractive index among the seven visible colours of light.

In summary, the colour of light with the highest refractive index is violet, based on its shorter wavelength and the relationship between wavelength and refractive index.

33. (i) Two common safety measures used in electric circuits and appliances are:

1. **Fuse:** A fuse is a safety device used in electric circuits to protect devices and wiring from excessive current. It consists of a thin wire that melts when the current exceeds a certain limit, breaking the circuit and preventing damage.
2. **Circuit Breaker:** Similar to a fuse, a circuit breaker is a safety device designed to protect electrical circuits from over current and short circuits. Unlike a fuse, a circuit breaker can be reset after tripping, making it more convenient.

(ii) To determine if the electric oven is suitable for use in a domestic electric circuit with a current rating of 5A, we can use the formula:

$$\text{Power (P)} = \text{Voltage (V)} \times \text{Current (I)}$$

Given:

- Voltage (V) of the electric oven = 220V
- Power (P) of the electric oven = 2kW (2000W)
- Current rating of the domestic electric circuit = 5A

We can rearrange the formula to find the current (I):

$$I = \frac{P}{V}$$

Substitute the given values:

$$I = \frac{2000}{220}$$

The calculated current (I) required by the electric oven is approximately 9.09A. This exceeds the current rating of the domestic electric circuit, which is only 5A. Therefore, the electric oven is not suitable for use in this domestic electric circuit and using it could lead to overloading and tripping of the circuit breaker.

To avoid this issue, a lower-power electric oven or upgrading the circuit to handle higher current loads would be necessary.

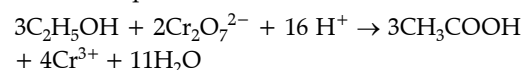
SECTION - D

34. (A) (i) A functional group is a specific atom or group of atoms within a molecule that imparts characteristic chemical and physical properties to the compound. It is the reactive center of a molecule, determining its reactivity and the type of chemical reactions it can undergo. Functional groups play a crucial role in organic chemistry, as they define the structure and behaviour of organic compounds.

(I) is carbonyl (C = O)

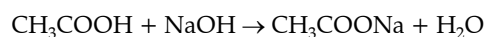
(II) is carboxyl (COOH) group.

(ii) Ethanol reacts with acidified potassium dichromate solution, undergoing oxidation. The chemical equation is:



This reaction is considered oxidation as ethanol loses hydrogen atoms and gains oxygen. The dichromate ions are reduced to chromium(III) ions.

(iii) The reaction between ethanoic acid (CH_3COOH) and sodium hydroxide (NaOH) is a neutralisation reaction. The chemical equation for this reaction is as follows:

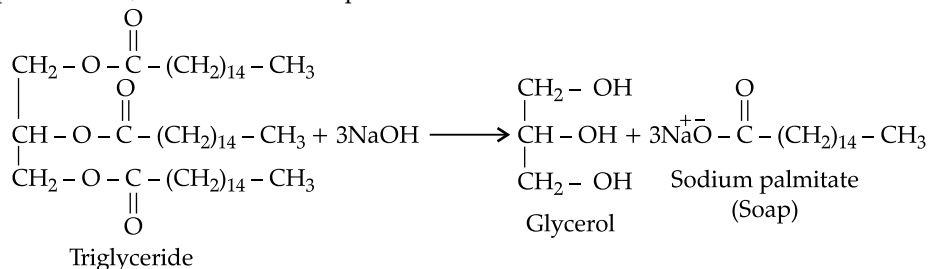


In this equation, ethanoic acid reacts with sodium hydroxide to form sodium acetate (CH_3COONa) and water (H_2O). This is a typical acid-base neutralisation reaction, where an acid reacts with a base to produce a salt and water.

OR

(B) (i) The method of preparation of soap involves a reaction called saponification, which is the hydrolysis of fats and oils in the presence of a strong base, typically sodium hydroxide (NaOH) or potassium hydroxide (KOH). The reaction results in the formation of soap molecules and glycerol. Here's the general chemical equation for the saponification reaction:

Triglyceride (fat or oil) + 3NaOH → Soap + Glycerol
In more specific terms, let's take the example of the



In this equation:

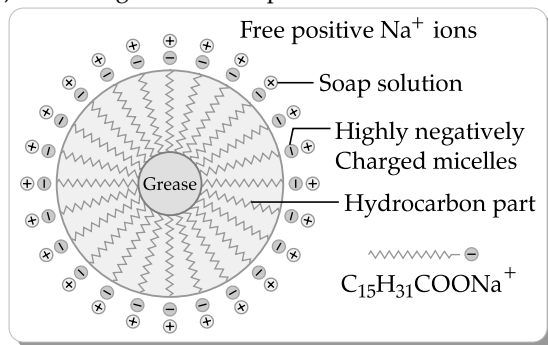
- The triglyceride represents the fat or oil, which is a triester of glycerol and three fatty acids.
- Sodium hydroxide (NaOH) is the strong base used in the saponification process.
- The soap formed is a sodium salt of the fatty acid and it consists of a hydrophobic (water-repelling) tail and a hydrophilic (water-attracting) head.
- Glycerol is a trihydric alcohol produced as a byproduct.

The soap molecules, being amphiphilic (having both hydrophobic and hydrophilic parts), can interact with both water and oily substances, allowing

saponification of a common fat, such as a triglyceride found in vegetable oil:

them to emulsify and lift away dirt and grease from surfaces.

(ii) Cleansing action of soap



SECTION - A

12. Option (C) is correct.

Explanation: The vas deferens is a part of the male reproductive system. It is a muscular tube that carries sperm from the testes to the urethra. Sperm move through the vas deferens during ejaculation, where they mix with fluids from the seminal vesicles and prostate gland to form semen.

14. Option (D) is correct.

Explanation: The upper part of a bifocal lens has a concave lens (diverging lens) so that a person can see distant objects from the upper part and the lower part has a convex lens (converging lens) so that the person can look through it to see near objects, i.e., for reading.

SECTION - B

21. (A) (i) The peripheral nervous system (PNS) is vital for sensory input and motor output. It includes sensory neurons detecting stimuli from the environment and motor neurons transmitting signals to muscles and glands. The PNS regulates involuntary functions through the autonomic nervous system, balancing physiological activities like heart rate and digestion. Reflex actions, quick responses to stimuli, are facilitated

by the PNS. It acts as a communication bridge between the central nervous system and peripheral organs, enabling coordination and control of bodily functions. The PNS comprises the somatic and autonomic systems, contributing to both voluntary and involuntary physiological processes in the human body.

(ii) The human brain is safeguarded from mechanical injuries and shocks through the skull's rigid protection, the cushioning effect of cerebrospinal fluid and the three layers of meninges. Additionally, the blood-brain barrier restricts harmful substances from entering brain tissue. The scalp, muscles and connective tissues contribute to impact absorption. Cranial nerves, reflexes and protective mechanisms like blinking and postural adjustments further aid in minimising potential harm. The evolved shape and structure of the skull provide optimal defense. Despite these safeguards, precautions like wearing helmets remain crucial for preventing traumatic brain injuries.

OR

(B) Chemotropism:

- **Directional Growth in Response to Chemicals:**
- **Example:** Plant roots exhibit positive

chemotropism by growing towards the source of specific chemicals, such as nutrients or water. The roots sense and move towards gradients of chemicals to optimise nutrient absorption.

Hydrotropism:

- **Directional Growth in Response to Water:**
- **Example:** Plant roots also display positive hydrotropism, directing their growth towards areas with higher water availability. This helps plants locate and access water sources essential for their hydration and survival.

22. (i) Herbivorous animals have longer small intestines than carnivorous animals due to the differences in their diets and digestive processes.

1. **Herbivorous Diet:**

- Herbivores primarily consume plant material, which is rich in complex carbohydrates like cellulose. Breaking down plant cell walls and extracting nutrients from plant matter require more extensive digestion.
- The longer small intestine provides a greater surface area for the action of enzymes and microorganisms involved in the breakdown of complex carbohydrates, allowing herbivores to extract maximum nutrients from plant-based diets.

2. **Carnivorous Diet:**

- Carnivores consume animal tissues, which are generally easier to digest compared to plant cell walls. Animal proteins and fats are more readily accessible for absorption.
- Carnivores have a relatively shorter small intestine as their diet doesn't necessitate an extended period for the breakdown of complex plant materials.

3. **Digestive Efficiency:**

- Herbivores rely on microbial fermentation in the cecum and colon to aid in the digestion of cellulose and other plant materials. A longer small intestine provides more time for the microbial processes required for efficient digestion of plant-based diets.
- Carnivores, on the other hand, primarily rely on gastric and pancreatic enzymes for the digestion of animal proteins and fats, processes that occur more efficiently in a shorter small intestine.

(ii) One key difference between Pepsin and Trypsin, despite both being protein-digesting enzymes, lies in their optimal pH range:

1. **Optimal pH Range:**

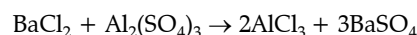
- **Pepsin:** Pepsin is active in the acidic environment of the stomach. Its optimal pH range for activity

is around 1.5 to 2.5. Pepsinogen, the inactive precursor of pepsin, is activated by the acidic conditions in the stomach to form active pepsin.

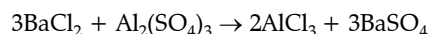
- **Trypsin:** Trypsin, on the other hand, functions in the alkaline environment of the small intestine. Its optimal pH range is around 7 to 9. Trypsinogen, the inactive form of trypsin, is activated by the enzyme enterokinase in the small intestine, where the pH is higher.

This difference in optimal pH reflects the environments in which these enzymes operate during the digestive process. Pepsin works in the stomach's acidic conditions, breaking down proteins into smaller peptides, while trypsin operates in the alkaline environment of the small intestine, further digesting peptides into amino acids.

23. The given statement can be translated into a balanced chemical equation as follows:



This balanced equation represents the reaction between barium chloride (BaCl_2) and aluminum sulphate ($\text{Al}_2(\text{SO}_4)_3$), producing aluminum chloride (AlCl_3) and barium sulphate (BaSO_4).



Type of Reaction: This is a double displacement or metathesis reaction. In this type of reaction, the cations and anions of two different compounds switch places, leading to the formation of two new compounds. In the given reaction, barium chloride and aluminum sulphate exchange ions to form aluminum chloride and barium sulphate.

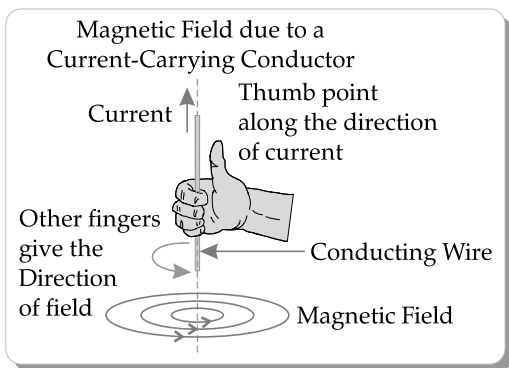
25. The magnetic field around a straight current-carrying conductor forms concentric circles centered around the conductor. To indicate the direction of the magnetic field and current, we can use the right-hand thumb rule:

1. **Right-Hand Thumb Rule for Conventional Current:**

- If you point your thumb in the direction of the current (the flow of positive charge), the direction in which your fingers encircle the conductor represents the direction of the magnetic field.

2. **Direction of Magnetic Field Lines:**

- The magnetic field lines form circles around the conductor and are perpendicular to the direction of the current.



SECTION - C

31. (i) Organisms with three-chambered hearts are commonly found among amphibians, reptiles except crocodile. Birds and mammals have four chambered hearts. The structure of a three-chambered heart consists of two atria and one ventricle.

Reasons for a Three-Chambered Heart:

1. Partial Separation of Oxygenated and Deoxygenated Blood:

- The three-chambered heart allows for a partial separation of oxygenated and deoxygenated blood.
- One atrium receives oxygenated blood from the lungs or respiratory surfaces, while the other atrium receives deoxygenated blood from the body.
- However, there is only one ventricle that pumps blood to both the lungs (or respiratory surfaces) and the rest of the body.

2. Efficiency in Maintaining Oxygen Levels:

- While not as efficient as the four-chambered heart found in mammals and birds, the three-chambered heart provides a degree of separation that allows for better maintenance of oxygen levels compared to a two-chambered heart.
- The partial separation prevents complete mixing of oxygenated and deoxygenated blood, enhancing the oxygen supply to the body.

3. Adaptation to Dual Environments:

- Many reptiles and birds are ectothermic (cold-blooded) and their metabolic rates are influenced by external temperatures. Having a three-chambered heart provides some adaptability to dual environments, such as terrestrial and aquatic habitats.

While a three-chambered heart is an improvement over a two-chambered heart in terms of oxygenation efficiency, it is not as efficient as a four-chambered heart. Mammals and birds typically have four-chambered hearts, which completely separate

oxygenated and deoxygenated blood, ensuring a more efficient oxygen supply to the body's tissues.

- (ii) Lymph plays crucial roles in the body's immune system and fluid balance. Here are two main functions of lymph:

1. Immune System Support:

- Lymph carries white blood cells, including lymphocytes, throughout the body. These cells are essential components of the immune system responsible for recognising and combating pathogens, such as bacteria, viruses and abnormal cells.
- Lymph nodes, which are distributed along the lymphatic vessels, act as filters where foreign particles and antigens are trapped and destroyed by immune cells.

2. Fluid Balance and Tissue Health:

- Lymphatic vessels collect excess interstitial fluid (fluid that surrounds cells) from tissues, preventing the accumulation of fluid and maintaining tissue health.
- The collected fluid, now called lymph, is transported through lymphatic vessels and eventually returned to the bloodstream, contributing to the overall fluid balance in the body.

These functions highlight the critical role of the lymphatic system in immune defense and maintaining the proper balance of fluids within tissues.

32. Compound Prepared from Gypsum:

- (i) **Common Name:** Plaster of Paris

Chemical Name: Calcium sulfate hemihydrate

- (ii) **Chemical Equation for Preparation:**



- (iii) **Two Uses:** Used in the construction industry for making plaster, molds and casts. Utilised in medicine for casting and setting fractured bones.

33. **Decomposition Reaction:** (i) **Definition:** A decomposition reaction involves the breakdown of a single compound into two or more simpler substances.



- (ii) **Electrolytic Decomposition of Water:** Two gases liberated: Hydrogen (H_2) at the cathode and oxygen (O_2) at the anode. Mass ratio of hydrogen to oxygen is 2:1 due to the molecular ratio in water (H_2O).

SECTION-D

34. (A) (i) The behaviour of currents and potential differences in bulbs depends on the arrangement of bulbs in a circuit. Let's analyse

each case:

(a) **Same Wattage Connected in Series:**

- **Current:** The same current flows through all bulbs in series.
- **Potential Difference:** The potential difference across each bulb adds up, so the potential difference is different for each bulb.
- **Conclusion:** Current is the same; potential difference is different.

(b) **Same Wattage Connected in Parallel:**

- **Current:** Different currents flow through bulbs in parallel.
- **Potential Difference:** The potential difference across each bulb is the same.
- **Conclusion:** Currents are different; potential difference is the same.

(c) **Different Wattage Connected in Series:**

- **Current:** The same current flows through all bulbs in series.
- **Potential Difference:** The potential difference across each bulb adds up, so the potential difference is different for each bulb.
- **Conclusion:** Current is the same; potential difference is different.

(d) **Different Wattage Connected in Parallel:**

- **Current:** Different currents flow through bulbs in parallel.
- **Potential Difference:** The potential difference across each bulb is the same.
- **Conclusion:** Currents are different; potential difference is the same.

(ii) The power consumed by a resistor in an electrical circuit can be calculated using the formula:

$$P = V^2/R$$

where:

- P is the power consumed,
- V is the voltage across the resistor,
- R is the resistance of the resistor.

For resistors in series: $\text{total} = R_1 + R_2$

For resistors in parallel: $1/R_1 + 1/R_2$

Let's calculate the power consumed in each case:

(a) Minimum Resistance (Parallel Configuration):

$$R_{\min} = (24 \times 24)/(24 + 24) = 12$$

$$I = V/R = 6/12 = 0.5A$$

$$P = I^2 R = 0.5^2 \times 12 = 3$$

(b) Maximum Resistance (Series Configuration):

$$R_{\max} = 24 + 24 = 48$$

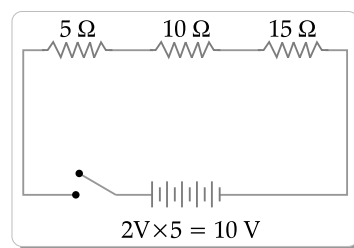
$$I = V/R = 6/48 = 0.125A$$

$$P = I^2 R = 0.125^2 \times 48 = 0.75$$

$$\text{Ratio} = 3 : 0.75$$

OR

(B)



(i) Total Resistance = $R_1 + R_2 + R_3 = 6 + 12 + 18 = 36 \Omega$
 $V = 6 \times 2 = 12$

$$\text{Using Ohm's law} = I = V/R = 12/36 = 1/3 = 0.33$$

(ii) The potential difference (V_{18}) across the 18 Ω resistor is given by Ohm's Law: $V_{18} = I \cdot R_{18} = 0.33 \times 18 = 5.94$

(iii) The electric power (P) consumed in the 18 Ω resistor is given by $P = I^2 \cdot R = 0.332 \times 18 = 1.96 \text{ Watt}$.

SECTION-A

1. **Option (D) is correct.**

Explanation: As heat is liberated so it is exothermic and calcium hydroxide $\text{Ca}(\text{OH})_2$ is formed which is a base so pH will be more than 7.

2. **Option (C) is correct.**

Explanation: Natural food items contains naturally occurring acids like tartaric acid, citric acid and malic acid. Tartaric acid is a naturally occurring organic acid found in various fruits, including tamarind. When tamarind juice comes into contact with blue litmus paper, which is a type of pH indicator, the tartaric acid present in the juice reacts with the litmus paper.

3. **Option (B) is correct.**

Explanation: Coal burns in the air to form carbon dioxide gas which is a combination reaction.

4. **Option (B) is correct.**

Explanation: As it is an amphoteric oxide which behaves as both acidic and basic oxides.

5. **Option (D) is correct.**

Explanation: $\text{CaSO}_4 + \text{Al}$ (in case of a) and $\text{FeSO}_4 + \text{Cu}$ (in case of c) in both cases Al and Cu are less reactive so cannot displace Ca and Fe from their sulphates. In case of $\text{CuSO}_4 + \text{Ca}$ and $\text{ZnSO}_4 + \text{Mg}$ in both cases Ca and Mg are more reactive so will displace Cu and Zn from their sulphates and CaSO_4 and MgSO_4 will be formed as new products.

6. Option (B) is correct.

Explanation: In the reaction, hydrogen sulphide (H_2S) gains oxygen, resulting in the formation of sulphur (S), which means hydrogen sulphide is being reduced.

7. Option (A) is correct.

Explanation: For homologous series succeeding members differ by $-\text{CH}_2$ unit and their melting and boiling point increases with increasing molecular mass because of stronger molecular forces.

8. Option (C) is correct.

Explanation: The left atrium receives oxygenated blood from the lungs and transfers it to the left ventricle, which pumps it to various body parts. Meanwhile, the right atrium receives deoxygenated blood from the vena cava, receiving from the upper and lower parts of the body.

9. Option (A) is correct.

Explanation: Pituitary gland is unpaired gland present below the hypothalamus of the brain.

10. Option (B) is correct.

Explanation: When a person inhales, muscles contract, moving the ribs upward and outward, which increases the volume of the thoracic cavity. The diaphragm flattens during inhalation to create more space for the lungs to expand.

11. Option (C) is correct.

Explanation: The diagram represents budding in Hydra.

12. Option (A) is correct.

Explanation: Parental pea plant have heterozygous (Tt) for the trait.

13. Option (A) is correct.

Explanation: The eyeball diameter in adults is approximately 2.3 cm. Dark muscular diaphragm is Iris and ciliary muscle helps in focusing images on retina by adjusting focal length. The majority of refraction in the eye occurs at the first surface, primarily at the transition from air into the cornea, representing the most significant change in the index of refraction encountered by light. Approximately 80% of refraction takes place in the cornea, with the remaining 20% occurring in the inner crystalline lens.

14. Option (A) is correct.

Explanation: Maximum resistance is when connected in parallel. $R_{\text{max}} = 5 \times R$ (resistance of 1 resistor)

15. Option (C) is correct.

Explanation: slope (for I/V) graph = $\frac{1}{R}$ is least for R_3

Hence, R_3 has the greatest resistance value

16. Option (C) is correct.

Explanation: The strength of the magnetic field

in a solenoid is primarily influenced by factors such as the number of turns in the coil, the current flowing through the coil and the permeability of the material inside the coil. The length of the solenoid is not a factor that directly affects the strength of the magnetic field.

17. Option (A) is correct.

Explanation: The extraction of a metal from its ore often depends on its position in the reactivity series. Metals high in the reactivity series, like sodium and potassium, are typically extracted by more reactive methods (e.g., electrolysis), while metals lower in the series, such as copper and iron, can be extracted by less reactive methods like smelting or reduction using carbon.

18. Option (B) is correct.

Explanation: Human females typically have a pair of sex chromosomes consisting of two X chromosomes (XX). This is in contrast to human males, who have one X and one Y chromosome (XY). The combination of sex chromosomes determines an individual's biological sex. In females, having two X chromosomes contributes to the development of female reproductive anatomy and the expression of female secondary sexual characteristics.

19. Option (A) is correct.

Explanation: Myopia, is a refractive error where distant objects appear blurry because the eyeball is too long or the cornea is too curved. Converging lenses are used to correct Myopia as it converges the incoming light ray.

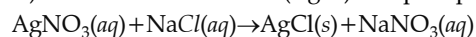
20. Option (D) is correct.

Explanation: In reality, when the current in a wire increases, the magnetic field around the wire becomes stronger and the deflection of a compass needle placed near the wire increases, not decreases. Therefore, the relationship between the deflection of the compass needle and the current in the wire is opposite to what is stated in Assertion (A).

SECTION-B

21. (a) The statement "No precipitation reaction can occur without exchange of ions between the two reactants" is based on the principle that precipitation reactions involve the formation of an insoluble salt through the combination of ions from different reactants. In these reactions, cations and anions in the solution come together to form an insoluble solid, known as a precipitate.

Let's consider the example of a precipitation reaction between silver nitrate (AgNO_3) and sodium chloride (NaCl) to form silver chloride (AgCl) as a precipitate:



In this reaction, ions are exchanged between the two reactants:

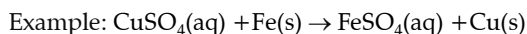
1. In AgNO_3 , silver ions (Ag^+) and nitrate ions (NO_3^-) are present.
2. In NaCl , sodium ions (Na^+) and chloride ions (Cl^-) are present.

Upon mixing, the silver ions (Ag^+) from AgNO_3 combine with the chloride ions (Cl^-) from NaCl to form the insoluble silver chloride (AgCl) precipitate. The sodium and nitrate ions remain in the solution as they are soluble.

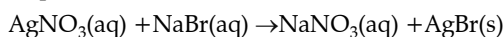
This exchange of ions is a crucial aspect of precipitation reactions and the formation of a solid precipitate is a clear indication of the occurrence of a precipitation reaction.

OR

- (b) Reaction in which higher reactive element displaces a less reactive element from its solution is displacement reaction



Reaction in which ions of both reactants interchange their place and form new compounds is double displacement reaction



22. "Translocation" or "Distribution" is the process involved in moving food from the leaves to other parts of the plant and it happens through special tubes called phloem. This ensures that all parts of the plant get the food they need to grow and stay healthy.
23. Sexual reproduction, through meiosis, ensures both genetic stability and diversity. Meiosis halves chromosome number, introducing variation through genetic recombination. This balance between conservation and adaptability promotes the stability of DNA in a species across generations.
24. (a) **Laws of refraction of light**
- (i) The incident ray, the refracted ray and the normal to the surface at the point of incidence all lie in one plane.
 - (ii) For any two given pair of media, the ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant. Snell's law

OR

Absolute refractive index: ratio of velocity of light in vacuum to velocity of light in the medium.

$$n = \frac{c}{v}$$

Given:

Absolute refractive index of glass (n) = 1.5

Speed of light in vacuum (c) = $3 \times 10^8 \text{ m/s}$

To find the speed of light in glass (v), we rearrange the formula for the absolute refractive

$$\text{index: } n = \frac{c}{v}$$

$$v = \frac{c}{n}$$

Substituting the given values:

$$v = \frac{3 \times 10^8}{1.5} = 2 \times 10^8 \text{ m/s}$$

So, the speed of light in glass is $2 \times 10^8 \text{ m/s}$.

25. As $V = IR$

$$I = \frac{V}{R}; I = \frac{2}{(1+3+2)}$$

$$I = \frac{1}{3} \text{ A Hence, } V \text{ (voltage across } 3 \Omega)$$

$$= \frac{1}{3} \times 3 = 1 \text{ Volt}$$

26. The term used for materials that cannot be broken down by biological processes is "non-biodegradable." Two ways in which non-biodegradable materials harm various components of an ecosystem are:

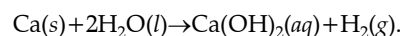
Pollution: Non-biodegradable materials, such as plastic and certain metals, can persist in the environment for extended periods. They accumulate in ecosystems, causing pollution in water bodies, soil and air. This pollution can harm aquatic life, soil organisms and disrupt the balance of the ecosystem.

Toxicity: Some non-biodegradable materials, like certain chemicals and heavy metals, can leach toxic substances into the environment. These toxins can negatively impact the health of plants, animals and humans in the ecosystem. They may lead to bioaccumulation, where the concentration of toxins increases as they move up the food chain, posing a threat to higher-level consumers.

SECTION-C

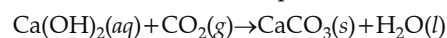
27. When calcium reacts with water, it floats on the surface of water because the reaction produces hydrogen gas and the bubbles of hydrogen gas generated during the reaction sticks to the surface of the calcium metal, causing it to float.

The balanced chemical equation for the reaction of calcium with water is

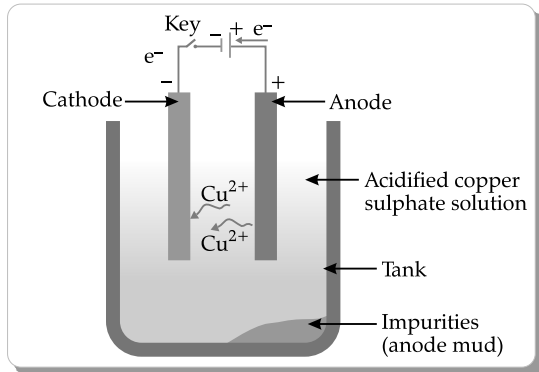


When the aqueous solution of calcium hydroxide reacts with carbon dioxide gas, calcium carbonate and water are formed.

The balanced chemical equation for this reaction is



28. Refining of copper:



When current is passed through the electrolyte, impure metal dissolves from the anode into the solution. The positive copper ions move towards the cathode, composed of pure copper. The metal cations absorb electrons from the cathode and are deposited on the cathode as Cu atoms and pure copper is produced at the cathode.

29. (A) (i) Alveoli in lungs are richly supplied with blood capillaries: The alveoli in the lungs are responsible for the exchange of gases, primarily oxygen and carbon dioxide, between the air and the blood. The rich supply of blood capillaries around the alveoli ensures efficient gas exchange. Oxygen from the inhaled air diffuses into the bloodstream through the thin walls of the capillaries, while carbon dioxide, produced during cellular respiration, moves from the blood into the alveoli to be exhaled. The close proximity of capillaries to alveoli facilitates a rapid exchange of gases, ensuring that oxygen is efficiently taken up by the blood and carbon dioxide is removed.
- (ii) Respiratory pigment in the blood takes up oxygen and not carbon dioxide: The respiratory pigment in the blood, primarily haemoglobin, has a high affinity for oxygen. In the lungs, where oxygen concentration is high, haemoglobin binds with oxygen to form oxyhaemoglobin. This oxygenated haemoglobin is then transported to body tissues through the bloodstream. In tissues with lower oxygen concentration, oxyhaemoglobin releases oxygen to support cellular respiration. While haemoglobin does have the capacity to bind with carbon dioxide, the majority of carbon dioxide is transported in the blood in the form of bicarbonate ions and through plasma. This selective binding of haemoglobin with oxygen ensures the efficient transport of oxygen to body tissues where it is needed.
- (iii) During anaerobic respiration, a 3-carbon molecule is formed as an end product instead of CO_2 in human beings: In anaerobic respiration,

which occurs in the absence of oxygen, the end product is not carbon dioxide (CO_2), but rather lactic acid (in humans) or ethanol and carbon dioxide (in some microorganisms). In the absence of sufficient oxygen, human cells undergo anaerobic glycolysis, producing a 3-carbon molecule called lactic acid. This process allows for the continuation of ATP production in the absence of oxygen. The buildup of lactic acid can lead to temporary muscle soreness. In contrast, in microorganisms like yeast, anaerobic respiration results in the production of ethanol and carbon dioxide.

OR

- (B) (i) **Movements that occur all along the gut in the human digestive system:** The movements that occur along the gut are called peristalsis. Peristalsis is the coordinated contraction and relaxation of smooth muscles in the walls of the digestive tract, which propels the food bolus through the digestive system. This movement occurs from the esophagus to the stomach, through the small intestine and into the large intestine. Peristalsis facilitates the mixing and digestion of food, helping in the breakdown and absorption of nutrients.
- (ii) **Where is bile juice stored in the human body:** Bile juice is stored in the gallbladder in the human body. It is produced by the liver and stored in the gallbladder until it is needed for digestion.

Two roles of bile juice:

- Emulsification of Fats:** Bile contains bile salts that help in the emulsification of fats. Emulsification breaks down large fat globules into smaller droplets, increasing the surface area for the action of digestive enzymes like lipase. This process aids in the digestion and absorption of fats in the small intestine.
 - Neutralisation of Chyme:** Bile is alkaline in nature and when released into the small intestine, it helps neutralise the acidic chyme coming from the stomach. This change in pH provides an optimal environment for the action of pancreatic enzymes, facilitating the digestion of carbohydrates, proteins and fats in the small intestine.
30. Once a sperm reaches the oviduct (fallopian tube), fertilisation can occur if it encounters a mature egg (oocyte). The events that take place from fertilisation to the development of a fetus can be outlined as follows:
- Fertilisation:** The sperm penetrates the egg, leading to the formation of a zygote. This fusion of genetic material restores the diploid chromosome number and initiates the development of a new individual.

Zygote Formation: The zygote undergoes rapid cell divisions through mitosis, forming a solid ball of cells called a morula.

Blastocyst Formation: The morula develops into a blastocyst, a fluid-filled structure with an inner cell mass. The blastocyst travels through the fallopian tube and reaches the uterus.

Implantation: The blastocyst attaches to the endometrial lining of the uterus and undergoes implantation. This process involves the invasion of the blastocyst into the uterine lining.

Formation of Germ Layers: After implantation, the blastocyst undergoes further development, forming three germ layers (ectoderm, mesoderm and endoderm), which give rise to various tissues and organs.

Formation of Embryo: The blastocyst transforms into an embryo and organogenesis begins. The major organs and body structures start to form during this period.

Development of Fetus: By the end of the eighth week, the developing organism is termed a fetus. The fetal stage involves further growth and maturation of organs and tissues.

Role of Placenta in Pregnancy: The placenta is a crucial organ formed during pregnancy. It serves several essential functions:

- 1. Nutrient and Gas Exchange:** The placenta facilitates the exchange of nutrients, oxygen and waste products between the mother's bloodstream and the developing fetus. It ensures that the fetus receives the necessary nutrients for growth and removes waste products.
- 2. Hormone Production:** The placenta produces hormones, such as human chorionic gonadotropin (hCG), progesterone and estrogen. These hormones play a vital role in maintaining pregnancy, preventing the release of additional eggs and supporting the development of the uterine lining.
- 3. Protection:** The placenta acts as a barrier, protecting the fetus from harmful substances and preventing the mother's immune system from attacking the developing organism.

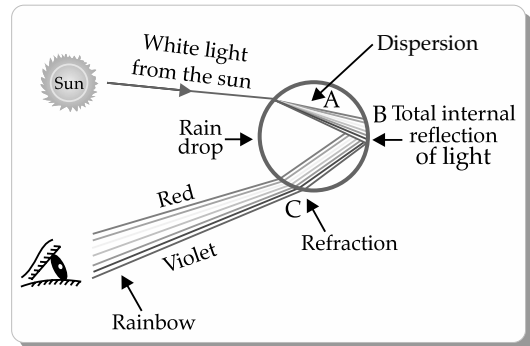
Overall, the placenta plays a crucial role in supporting the developing fetus throughout pregnancy by facilitating nutrient and gas exchange and producing essential hormones.

31. (a) **Power of Accommodation:** The power of accommodation of the human eye refers to its ability to adjust its focus in order to see objects clearly at different distances. The part of the eye that plays a major role in the process of accommodation is the lens.

(i) **Nearby Objects:** The ciliary muscles surrounding the lens contract, as a result lens get thicker and focuses on the nearby object.

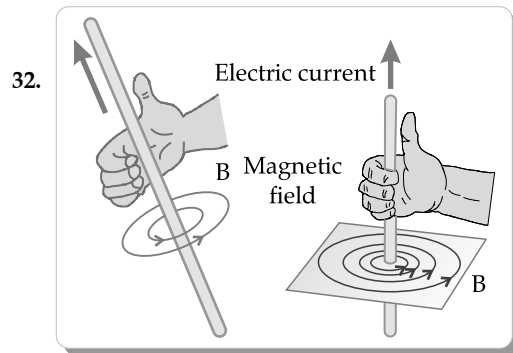
(ii) **Distant Objects:** The ciliary muscles surrounding the lens relaxes, as a result lens get thinner and focuses on the nearby object.

OR



Two necessary conditions to observe a rainbow:

- The sun needs to be behind the viewer.
- The sun needs to be at an angle of less than 42° above the horizon.



Right hand thumb rule: According to this rule, "If you imagine holding a current carrying wire in your right-hand with your thumb pointing towards the direction of electric current flow then the direction in which your fingers curl, gives the direction of lines of force of the magnetic field".

Yes it is accordance to the right hand rule.

33. The phenomenon involved in the use of pesticides affecting organisms at various trophic levels, especially human beings, is known as "biomagnification" or "bioaccumulation."

Biomagnification: This is the process where certain substances, such as pesticides, become more concentrated at higher trophic levels in a food chain.

Explanation:

- 1. Pesticide Application:** Pesticides are chemicals designed to kill or control pests that damage crops. Farmers use pesticides to protect their crops from insects, fungi and other harmful organisms.

2. **Uptake by Plants:** When pesticides are applied to crops, some residues may be absorbed by the plants. These residues can be present on the surface of the plants or within the plant tissues.
3. **Ingestion by Herbivores:** Herbivores, such as insects or animals that eat plants, consume the pesticide residues present on or within the plants. The concentration of pesticides in the herbivores can be higher than that in the plants.
4. **Bioaccumulation:** As we move up the food chain, the concentration of pesticides tends to increase. Predators that feed on herbivores accumulate higher levels of pesticides in their bodies.
5. **Impact on Humans:** When humans consume organisms from higher trophic levels, such as fish or livestock that have bioaccumulated pesticides, the concentration of these chemicals can be significantly higher in human tissues. This is particularly relevant for persistent organic pollutants, including some pesticides, which resist breakdown and elimination in the environment.
6. **Health Effects:** Pesticides can have adverse effects on human health. Chronic exposure to certain pesticides has been linked to various health issues, including neurological disorders, reproductive problems and cancers.

SECTION-D

34. (a) (i) To achieve a stable electron configuration, carbon tends to either lose 4 electrons to form a C^{4+} cation or gain 4 electrons to form a C^{4-} anion. Both of these scenarios are highly energetically unfavourable. Carbon can achieve a stable electron configuration by sharing electrons through covalent bonding rather than by gaining or losing electrons.
- (ii) It refers to a group of organic compounds that have similar chemical properties and structural features but differ from each other by a common structural unit.

Two consecutive members:

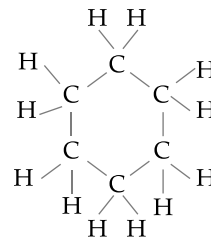
Methanal (Formaldehyde):

- Molecular Formula: CH_2O
- Structure: $H-CHO$

Ethanal (Acetaldehyde):

- Molecular Formula: C_2H_4O
- Structure: CH_3-CHO

(iii) Structure of cyclohexane



OR

- (b) (i) Carbon compound having the functional group $-OH$ is ethanol.
Molecular formula: C_2H_5OH
- (ii) (1) $C_2H_5OH + Na \rightarrow C_2H_5ONa + H_2$
End product: sodium ethoxide and hydrogen gas
- (2) $C_2H_5OH \rightarrow C_2H_4 + H_2O$
End product: ethene (ethylene) gas (C_2H_4) and water (H_2O)
- (3) $C_2H_5OH + CH_3COOH \rightarrow C_2H_5COOCH_3 + H_2O$
End product: ethyl ethanoate (ethyl acetate) and water
- (4) $C_2H_5OH + K_2Cr_2O_7 + H_2SO_4 \rightarrow CH_3CHO + Cr_2(SO_4)_3 + K_2SO_4 + H_2O$
End product: Ethanal (acetaldehyde) and chromium(III) sulfate ($Cr_2(SO_4)_3$)
35. (a) (i) Differences between hormonal coordination in plants and animals:

Animals	Plants
Hormones are primarily produced by specialised glands	Hormones are synthesised in various tissues and organs
Hormones are typically small organic molecules or proteins	Hormones are often small organic molecules known as phytohormones or plant growth regulators
Hormones are transported through the bloodstream	Hormones can be transported through vascular tissues
Hormonal regulation involves complex feedback mechanisms and interactions between different glands and hormones	Hormonal regulation influences various aspects of plant growth and development

- (ii) (1) Cerebrum
(2) Cerebellum
(3) Medulla oblongata
(4) Hypothalamus
- (iii) The brain and spinal cord are protected by the skull and by a meninges and also by cerebrospinal fluid.

OR

(b) (i) **Tropic Movements:** Tropic movements are directional movements in plants in response to external stimuli. These movements are often growth-oriented and occur towards or away from a stimulus. There are different types of tropic movements:

1. **Phototropism:** Growth of plants towards or away from light.
2. **Geotropism/Gravitropism:** Growth of plants towards or away from gravity.
3. **Thigmotropism:** Growth or development in plants in response to touch or mechanical stimuli.

Example of a Plant Hormone:

1. **Inhibits Growth:** Auxin is a plant hormone that can inhibit growth. For example, high concentrations of auxin in the apical meristem suppress lateral bud growth, known as apical dominance.
2. **Promotes Cell Division:** Cytokinin is a plant hormone that promotes cell division.

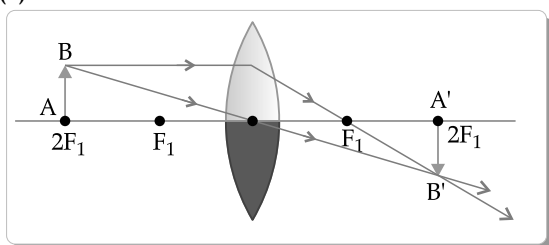
(ii) **Directional Movement of a Tendril in Pea Plant:**

In pea plants, tendrils exhibit thigmotropism, a type of tropic movement in response to touch. When a tendril encounters a support (like a neighboring plant or structure), it wraps around it. The directional movement is a result of differential growth on the side of the tendril that is in contact with the support. Cells on the side in contact with the support elongate more slowly than those on the opposite side, causing the tendril to curve and wind around the support.

Hormone Responsible for Thigmotropism:

The hormone responsible for thigmotropism in tendrils is auxin. When the tendril touches a support, there is an uneven distribution of auxin, leading to differential growth and the observed directional movement. This mechanism allows the tendril to effectively grasp and climb a supporting structure

36. (a)



The image formed will be real, inverted and located at the focal point F on the opposite side of the lens.

The observable difference in the image obtained when the lens is uncovered is that the entire

object will be visible in the image, as opposed to when only the lower half of the lens is used, where only the lower half of the object will be visible. The reason for this difference lies in the fact that when only the lower half of the lens is used, only the lower rays from the object can pass through the lens, leading to the formation of only the lower half of the image. However, when the entire lens is used, all rays from the object can pass through the lens, resulting in the formation of the complete image.

(b) To determine the distance of the image from the optical center of the concave lens using the lens formula, we can use the equation:

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

where:

- f is the focal length of the concave lens (given as -15 cm since it's concave)
- v is the distance of the image from the optical center of the lens (what we want to find)
- u is the distance of the object from the optical center of the lens (given as -30 cm since it's on the opposite side of the direction of the incident light)

Now, let's substitute the given values into the lens formula and solve for v :

$$\frac{1}{-15} = \frac{1}{v} - \frac{1}{-30}$$

First, Let's simplify the equation:

$$\frac{-1}{15} = \frac{1}{v} + \frac{1}{30}$$

Now, let's find the common denominator:

$$\frac{-3}{30} = \frac{1}{v}$$

Now, we can solve for u :

$$\frac{1}{v} = \frac{-3}{30}$$

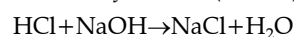
$$v = \frac{30}{-3}$$

$$v = -10 \text{ cm}$$

So, the distance of the image from the optical center of the concave lens is -10 cm.

SECTION-E

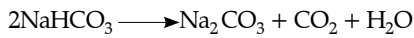
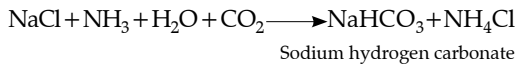
37. (a) Acid is hydrochloric acid (HCl) and the base is sodium hydroxide (NaOH).



(b) Calcium sulphate (CaSO_4) consists of the cation calcium (Ca^{2+}) and the anion sulphate (SO_4^{2-}).

(c) Sodium chloride (NaCl) and washing soda (Sodium carbonate, $\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$) both belong to the same family of salts known as

Sodium family because both have sodium as a cation. Washing soda is produced from sodium chloride. Reaction is given below.



OR

(c) **pH Scale:** The pH scale is a logarithmic scale used to specify the acidity or basicity of an aqueous solution. It measures the concentration of hydrogen ions (H^+) in a solution. The pH scale ranges from 0 to 14, where:

- pH less than 7 indicates acidity,
 - pH equal to 7 indicates neutrality and
 - pH greater than 7 indicates alkalinity or basicity.
- The salt obtained by the reaction of potassium hydroxide (KOH) and sulfuric acid (H_2SO_4) is potassium sulphate (K_2SO_4). The pH value of its aqueous solution will be close to 7, indicating neutrality.

38. (a) Among the cut pieces of *Planaria* A and *Planaria* B, the cut pieces L, M, N, O and P have the potential to regenerate into complete organisms. *Planaria* is capable of regeneration and each of these cut pieces can develop into a complete organism over time.

(b) An example of another organism that follows the same mode of reproduction as *Planaria* is the starfish. Starfish can regenerate from a lost arm and in some species, a severed arm can grow into a complete individual.

(c) In the context of regeneration, "development" refers to the process by which a severed or damaged part of an organism undergoes cell division, differentiation and growth to form a complete and functional organism. During regeneration, specific cells at the site of injury or cutting undergo specialisation and division to give rise to various cell types needed for the formation of tissues and organs.

OR

(c) **Differentiation Between Regeneration and Fragmentation:**

1. **Regeneration:**

- **Definition:** Regeneration is the ability of an organism to re-grow or replace lost or damaged body parts.
- **Process:** It involves the development of specialised cells at the site of injury, leading to the formation of new tissues and structures.
- **Example:** *Planaria* can regenerate into complete organisms from cut pieces.

2. **Fragmentation:**

- **Definition:** Fragmentation is a form of asexual reproduction where an organism breaks into

fragments and each fragment has the potential to grow into a new individual.

- **Process:** Fragments develop into new individuals without necessarily undergoing the specialisation of cells as seen in regeneration.
- **Example:** Some species of flatworms, like the tapeworm, reproduce through fragmentation.

39. (a) **Properties of Heating Elements:**

1. **High Resistance:** Heating elements are designed to have high electrical resistance, which facilitates the conversion of electrical energy into heat energy when current flows through them.
2. **Good Heat Resistance:** Heating elements should have good heat resistance to withstand the elevated temperatures generated during their operation.

(b) **Properties of Electric Fuse:**

1. **Low Melting Point:** The fuse wire in an electric fuse is made of a material with a low melting point. This property allows the fuse to melt quickly when a current higher than the rated value passes through it, breaking the circuit.
2. **Good Conductivity:** While in a solid state, the fuse wire should still have good electrical conductivity to allow normal current to pass through without significant resistance.

(c) **Principle of Electric Fuse and How it Works:**

- **Principle:** The electric fuse works on the principle of the heating effect of electric current. When a current higher than the rated value flows through the fuse wire, it heats up due to its electrical resistance.
- **Fuse Wire's Capability to Save Appliances:**
- **Low Melting Point:** The fuse wire is chosen to have a low melting point.
- **Quick Melting:** When an excess current flows through the circuit, the fuse wire quickly reaches its melting point, causing it to melt and break the circuit.
- **Interrupts the Current:** By breaking the circuit, the fuse interrupts the flow of excessive current, preventing it from reaching and potentially damaging electrical appliances.
- **Protects Devices:** The fuse acts as a sacrificial element, sacrificing itself by melting to protect the electrical appliances and devices connected to the circuit.
- **Safety Measure:** The use of a fuse is a safety measure to prevent fire hazards and protect electronic equipment from damage due to high currents or faults in the circuit.

OR

$$(c) \text{ Power (P)} = \frac{V^2}{R}$$

$$R = \frac{V^2}{P}$$

$$R = \frac{48400}{1100} = 44 \Omega$$

Now, current using Ohm's law

$$I = \frac{V}{R} = \frac{220}{44} = 5A$$

Outside Delhi Set-2

64/4/2

SECTION-A

2. **Option (D) is correct.**

Explanation: Electronic configuration of potassium (atomic number 19) is 2, 8, 8, 1. Therefore, required shell numbers are 4.

5. **Option (D) is correct.**

Explanation: Bronze contains around 88% to 95% copper and 5% to 12% tin

6. **Option (A) is correct.**

Explanation: It starts when pH level of mouth fall below 5.5.

11. **Option (D) is correct.**

Explanation: Shown diagram is of Rhizopus.

14. **Option (C) is correct.**

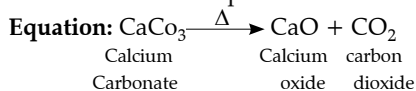
Explanation: $\rho = \frac{RA}{l}$. The SI unit of electrical resistivity is the ohm-metre ($\Omega \cdot m$).

20. **Option (A) is correct.**

Explanation: Metals in the middle of the activity series are generally found in nature as sulfides or carbonates. This is because metals in the middle of the activity series are moderately reactive and tend to form compounds with sulfur (sulfides) or carbonates in nature.

SECTION-B

21. (a) **Decomposition reaction:** It is a type of reaction in which a single compound breaks down into two or more simpler substances.



OR

(b) **Balanced chemical equation:** It is the one in which the number of atoms of each element is the same on both the reactant and product sides.

Importance: to satisfy law of conservation of mass.

22. (a) Test tube A will show change in color from blue-black to light yellow-brown.

Now, if an electric fuse rated at 5 A is connected in this circuit, it will operate normally. The fuse is designed to handle a current of up to 5 A. Since the current flowing in the circuit is exactly 5 A, the fuse will not blow and the circuit will continue to operate without any issues. However, if the current were to exceed 5 A, the fuse would blow, interrupting the circuit and preventing damage to the electrical components.

(b) This shows process of enzymatic digestion of starch due to amylase present in saliva.

23. Two type of germ cells are Sperm cells and Egg cells.

Differences:

Sperm cells	Egg cells
Smaller in size and are microscopic	Large in cells can be seen with naked eyes.
Streamline shape with long tail	Round or oval in shape

28. (a) Pollination is transfer of pollen grains from male reproductive organ to female reproductive organ, so without it fertilisation is not possible. Zygote is located within ovule after fertilisation. It develops into embryo which forms the seed.

(b) (i) Testis: Stamens (ii) Ovary: Pistil or Carpel

29. (a) (i) At cathode, hydrogen gas bubbles are formed which rises to the surface of water.

(ii) At anode, oxygen gas bubbles are formed which also rises to the surface of water.

(b) For every 2 moles of hydrogen gas produced at cathode, 1 mole of oxygen gas is produced at anode and as their molar masses are approximately 2g/mol (hydrogen gas) and 32g/mol (oxygen gas) of ratio of their masses is nearly 1:16. So the mass of hydrogen gas collected at cathode to the mass of oxygen gas collected at anode is 2:1.

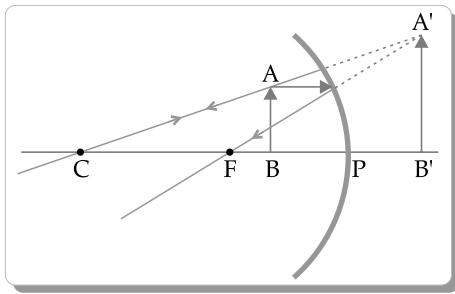
31. (a) **Mirror formula:** $1/f = 1/v - 1/u$

Given $f = -12 \text{ cm}$ and $u = 8 \text{ cm}$

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

$$\frac{1}{v} = \frac{-2}{24} - \frac{3}{24} \quad \frac{1}{v} = \frac{-5}{24} \quad v = \frac{-24}{5} = -4.8 \text{ cm}$$

The negative sign indicates that the image is formed on the same side as that object.



OR

(b) (i) Magnification, $m = \frac{-v}{u}$

Given, $m = -1, v = -30$ cm

$$-1 = -\frac{(-30)}{u}$$

$u = 30$ cm, object is placed at a distance of 30 cm from the mirror.

Justification: to satisfy these conditions object should be placed at focal point of mirror, then only image will be formed of same size.

(ii) If object is moved 15 cm towards the mirror, the new object distance (u) is 15 cm less than the original object distance (u).

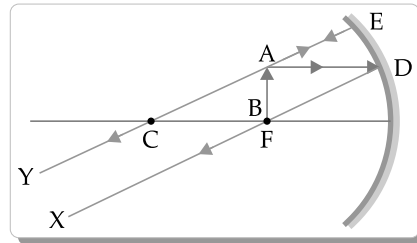
$u = 30$ cm

$u' = 30 - 15 = 15$ cm

Using mirror formula new image distance will be:

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{15}$$

$$\frac{1}{v} = \frac{-2}{15} \quad v' = \frac{-15}{2} = -7.5 \text{ cm}$$



32. (a) Extend your forefinger, middle finger and thumb of your left hand perpendicular to each other. If the forefinger signifies the magnetic field's direction and the middle finger denotes the current direction, then the thumb points out the motion of the conductor.

As current flows through the conductor, it experiences displacement, confirming the presence of a force acting on the conductor. This phenomenon is illustrated by the Left-Hand Rule, a principle commonly employed in physics to understand the relationship between the magnetic field, current direction and the resulting motion of a conductor.

(b) When an electron enters a magnetic field in the same direction as the current flowing in the conductor AB, it will experience a force in the opposite direction to that experienced by the current-carrying conductor. This is based on the right-hand rule for the force on a moving charged particle in a magnetic field.

SECTION-A

1. **Option (B) is correct.**

Explanation: When an iron nail is placed in a copper solution for 15 minutes, a redox reaction known as a displacement reaction or single replacement reaction occurs. Iron nail will be covered with layer of solid copper.

3. **Option (D) is correct.**

Explanation: The decomposition involves breaking the strong bonds between calcium (Ca), carbon (C) and oxygen (O) atoms in the calcium carbonate molecule. Energy is required to overcome these bond energies and facilitate the separation of the constituent elements. This energy is absorbed from the surroundings in the form of heat, making the reaction endothermic.

8. **Option (D) is correct.**

Explanation: it belongs to Bryophyllum that is growing vegetatively by leaves.

15. **Option (C) is correct.**

Explanation: The refractive index (n) of a medium is defined as the ratio of the speed of light in a vacuum (c) to the speed of light in that medium (v). Mathematically, it can be expressed as:

$$n = c/v$$

Given that the speed of light in a vacuum (c) is 3×10^8 m/s and the speed of light in the medium (v) is 2.25×10^8 m/s, The refractive index:

$$= 3 \times 10^8 \text{ m/s} / 2.25 \times 10^8 \text{ m/s}$$

$$= \frac{4}{3}$$

Therefore, the refractive index (n) of the medium is

$$\frac{4}{3}$$

16. **Option (D) is correct.**

Explanation: Fuse contains a wire which melts and breaks the circuit when current flows above certain limit, High current flow through circuit during short circuit

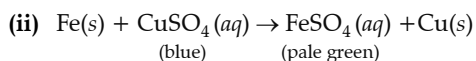
17. Option (A) is correct.

Explanation: Carbon is able to reduce the oxides of sodium and magnesium because these metals have a greater affinity for oxygen compared to carbon, allowing carbon to displace oxygen from their oxides through a reduction reaction.

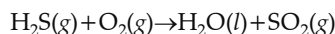
19. Option (C) is correct.

Explanation: The assertion is true and can be supported by scientific principles of Rayleigh scattering. The reason is false as it inaccurately states the relative wavelengths of blue and red light.

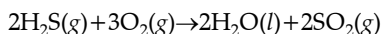
SECTION-B



(b) (i) Chemical equation:



Balanced equation:



(ii) Chemical equation:

Balanced equation: $2\text{AgBr}(s) \rightarrow 2\text{Ag}(s) + \text{Br}_2(g)$

22. **Blood Vessel Bringing Blood to the Kidneys:** The blood vessel that brings blood to the kidneys is the **renal artery**. The renal artery carries oxygenated blood from the heart to the kidneys, where the blood undergoes filtration and waste removal.

Nephron - Basic Filtration Unit of Kidney: The nephron is considered the basic filtration unit of the kidney due to its role in the process of urine formation. Each kidney contains millions of nephrons and their primary function is to filter blood and regulate the composition of urine. The nephron accomplishes this through a series of intricate processes, including filtration, reabsorption and secretion.

Role of Tubular Part of Nephron in Urine Formation:

The tubular part of the nephron, which includes the renal tubule, plays a crucial role in urine formation through several processes:

- **Filtration:** Blood enters the nephron through the glomerulus and the filtrate is formed by filtering out water, ions and small molecules from the blood into Bowman's capsule.
- **Reabsorption:** As the filtrate moves through the renal tubule, essential substances like glucose, water and ions are reabsorbed back into the bloodstream to maintain a proper balance in the body.
- **Secretion:** Additional substances, such as excess ions and waste products, are actively secreted from the blood into the renal tubule.

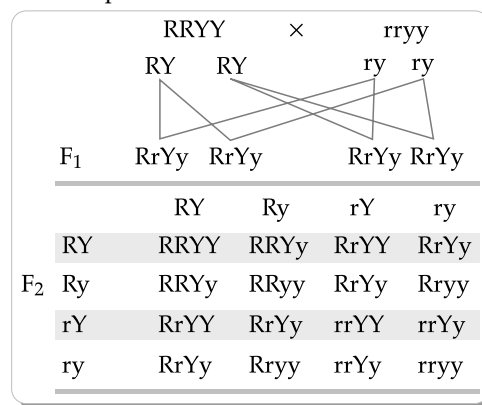
- **Concentration:** The remaining fluid, now called urine, undergoes concentration in the collecting duct before being transported to the renal pelvis for excretion.

23. **F₁ Generation (First Filial Generation):** In the F₁ generation, Mendel crossed a round and yellow-seeded pea plant with a wrinkled and green-seeded pea plant. The plants in the F₁ generation all exhibited the dominant traits from the parental generation, so they had round and yellow seeds.

F₂ Generation (Second Filial Generation): Upon self-pollinating the F₁ generation plants, Mendel observed different combinations of traits in the F₂ generation. The four types of combinations and their ratios are based on Mendel's laws of segregation and independent assortment:

1. **Round and Yellow Seeds (9:3:3:1):** 9 plants had round and yellow seeds.
2. **Round and Green Seeds (9:3:3:1):** 3 plants had round and green seeds.
3. **Wrinkled and Yellow Seeds (9:3:3:1):** 3 plants had wrinkled and yellow seeds.
4. **Wrinkled and Green Seeds (9:3:3:1):** 1 plant had wrinkled and green seeds.

The phenotypic ratio in the F₂ generation is 9:3:3:1, representing the different combinations of seed shape and color resulting from the independent assortment of alleles.



25. (a) **Defect of Vision and Corrective Lens:** The person suffering from an eye defect and using lenses with a power of -1 D has **myopia** or **nearsightedness**.

Causes of Myopia:

1. **Elongation of the Eyeball:** In myopia, the eyeball is longer than normal, causing the light to focus in front of the retina instead of on it.
2. **Increased Curvature of the Cornea or Lens:** An excessively curved cornea or lens can contribute to the light focusing in front of the retina.

Nature of Corrective Lens: The corrective lens for myopia is a **diverging lens**. A diverging lens helps to spread out the incoming light rays before they enter the eye, allowing them to focus correctly on the retina.

OR

(b) **Presbyopia and Corrective Lenses:** **Presbyopia** is a vision condition that typically occurs with aging, usually after the age of 40. It is characterised by a gradual loss of the eye's ability to focus on nearby objects.

Corrective Lenses for Presbyopia: The type of lenses used for the correction of presbyopia are **bifocal lenses**.

Nature of the Upper Part of Bifocal Lenses: The upper part of bifocal lenses is **diverging**. The diverging upper part helps in distant vision, while the lower part is usually converging to assist in near vision. This design allows individuals with presbyopia to have a single pair of glasses that corrects both distance and near vision.

27. (a) Sodium metal is highly reactive with moisture in the air forming sodium hydroxide and releasing

hydrogen which release significant amount of heat resulting in fire.

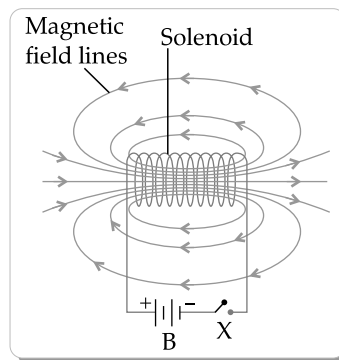
(b) Metal hydroxide solution or basic solution

Example: $\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow 2\text{NaOH}$

(c) Thin layer is composed of metal oxides and hydroxides.

Importance: it act as protective layer from corrosion for underlying metal.

32. **Solenoid:** A coil of wire wound in the form of a helix or spiral.



Magnetic field inside the solenoid is very strong and make the soft iron core an electromagnet.

