

SOLVED

Latest CBSE Sample Question Paper

Time Allowed : 3 Hours

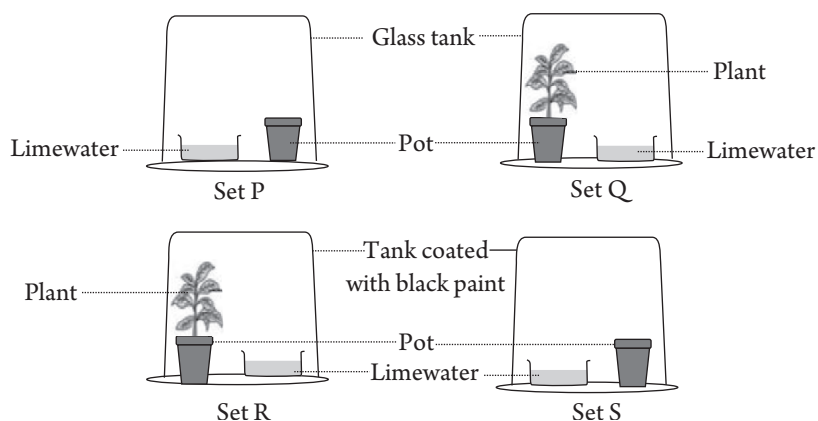
Maximum Marks : 80

General Instructions:

- (i) This question paper consists of 39 questions in 3 sections. Section A is Biology, Section B is Chemistry and Section C is Physics.
- (ii) All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of the alternatives in these questions.

Section A

1. During photosynthesis, what happens to carbon dioxide and water as glucose is formed? 1
 - (a) Carbon dioxide gains hydrogen, while water loses electrons.
 - (b) Carbon dioxide loses oxygen, while water gains oxygen.
 - (c) Carbon dioxide is oxidised, while water is reduced.
 - (d) Both carbon dioxide and water undergo reduction.
2. Lime water turns cloudy in the presence of a gas, which is a by-product of respiration. Shown below are four set-ups kept in sunlight for 24 hours. In which set-up is lime water expected to be the cloudiest? 1



- (a) P (b) Q (c) R (d) S
3. During urine formation, tubular reabsorption and secretion take place in the kidneys. Which of the following sets correctly indicates both the substances that are reabsorbed in the kidneys? 1
 - (a) Glucose and salts
 - (b) Glucose and starch
 - (c) Glycogen and salts
 - (d) Glycogen and starch

4. In a controlled experiment, the anthers of a mustard plant's flowers were carefully removed in the bud stage before they matured. The bud was covered with a paper bag.

What will be the most likely result for these flowers?

1

- (a) They will still produce seeds and fruit through self-pollination.
 - (b) They will attract more insects and produce larger flowers but no fruit.
 - (c) They will not produce any seeds or fruits.
 - (d) They will produce seeds and fruits that are genetically identical to the parent.
5. The vas deferens and the oviduct are both targets for surgical contraception (vasectomy and tubectomy respectively). Analysing the process of reproduction, what common biological event is prevented by blocking both these structures?
- 1
- (a) The production of gametes (sperm and egg).
 - (b) The implantation of the fertilised egg into the uterine wall.
 - (c) The successful meeting and fusion of the male and the female gametes.
 - (d) The release of hormones – testosterone and estrogen.
6. The male gamete of an apple plant has seventeen chromosomes. What is the number of chromosomes in the female gamete and in the cells of the adult plant respectively?
- 1
- (a) 17, 17
 - (b) 17, 34
 - (c) 34, 34
 - (d) 34, 51
7. A fish living in a pond ecosystem feeds on small aquatic insects (larvae). These insect larvae, in turn, feed on green algae and small photosynthetic bacteria. In this specific food chain, what is the trophic level classification of fish?
- 1
- (a) Producer
 - (b) Primary consumer
 - (c) Secondary consumer
 - (d) Tertiary consumer

The following two questions consist of two statements – Assertion (A) and Reason (R). Answer these questions by 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, and R is not the correct explanation of A.
 - (c) A is true but R is false.
 - (d) A is false but R is true.
8. **Assertion (A):** The rate of breathing in aquatic organisms is much lower than in the terrestrial organisms.
- Reason (R):** The amount of oxygen dissolved in water is less as compared to the amount of oxygen in air.
- 1
9. **Assertion (A):** In an ecosystem, 1% of energy is available for transfer from one trophic level to the next.
- Reason (R):** An average of 10% of the food eaten by organisms is available for flow in the form of chemical energy.
- 1
10. (a) Due to narrowing of the bile duct, the bile secretion from the liver to the small intestine was obstructed. How will the process of digestion be affected?
- (b) How does the length of the intestine depend on the nature of food habit in different animals? 2

11. Students to attempt either option (a) or (b). 2

- (a) Which parts of the brain perform certain actions for which we do not have any thinking control? What are such actions called, give two examples.

OR

- (b) How is the information of touch in the 'sensitive plant' controlled and coordinated?

12. What changes are observed in the uterus subsequent to implantation of the young embryo in a human female? 2

13. How do muscles move at the cellular level and respond when processed messages are received from the brain? 3

14. Study the food chain given below: 3

Phytoplankton → zooplankton → small fishes → large fish

- (a) In the given food chain, the amount of energy available at the fourth trophic level is 10 kJ, what will be the energy available at the producer level?
- (b) Is it possible to have three more trophic levels in the above food chain? Justify.
- (c) Which of these trophic levels will have the maximum amount of pesticide, if it had washed down in the water body from agricultural fields. Why?
15. In order to study patterns of inheritance, Neha had performed typical Mendelian experiments with pea plants in the field. In experiment one, she crossed a pea plant having white flowers (vv) with another pea plant bearing violet flowers (VV). In another experiment, in addition to the colour of the flower she also focussed on the height of the pea plant. This time she crossed a pea plant having violet flowers and tall height (VVTt) with another pea plant having white flowers and short height (vvtt). 4

What percentage is expected for the following traits as a result of these experiments? Give a reason.

(a) Violet flowers in F_1 and F_2 generations in experiment one? 1

(b) Tall height plants with white flowers in F_2 generation in experiment two? 1

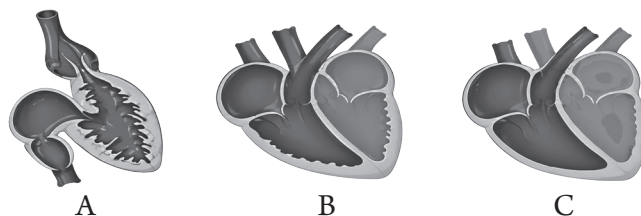
Attempt either sub-part (c) or (d).

(c) Percentage of medium height plants with light violet flowers in F_1 and F_2 generations in experiment two? Give a reason. 2

OR

(d) Percentage of short height plants with white flowers in F_1 and F_2 generations in experiment two? 2

16. Attempt either option (a) or (b). 5



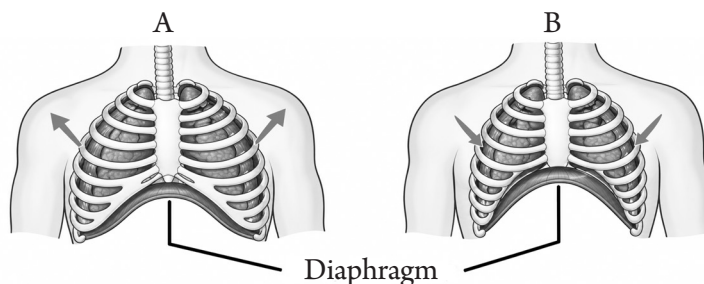
(a) Observe the structure of hearts A, B and C shown above and answer the following questions:

- (i) Which of the hearts depicted above is present in both birds and Mammals and how are they able to maintain their body temperature? Give reason for your answer.

- (ii) Which of the hearts depicted above is present in fishes, how does circulation of blood take place in them?

OR

- (b) (i) Observe both the diagrams A and B Which diagram indicates inhalation? Describe how it occurs.



- (ii) If diffusion were to move oxygen in our body, it is estimated that it would take 3 years for a molecule of oxygen to get to our toes from our lungs. Then, how is oxygen delivered to all parts of our body?

Section B

17. Chameleons contain crystals that reflect light and produce colour. Adjusting the spacing between these crystals, they can alter the wavelengths of light reflected, thus changing their skin colour. Based on the above information, we can infer that the change in colour by chameleons is a: 1
- (a) chemical change because change in colour takes place.
- (b) chemical change because wavelength of reflected light changes.
- (c) physical change because the space between crystals is adjusted.
- (d) physical change because light is reflected by crystals.
18. Rishita summarizes the chlor-alkali process in the following table: 1

Option	Product	Formed	Use
I	Hydrogen	At cathode	Used as a fuel
II	Chlorine	At anode	Used to make margarine
III	Sodium Hydroxide	Near cathode	To make soap
IV	Sodium Hydroxide	Near anode	To make bleaching powder

Identify the options that are correctly matched.

- (a) I, II and III (b) I and III (c) II and IV (d) I, II, III and IV
19. Manjeet wants to wash clothes, but the water available is hard. He compares the action of soap and detergent in hard water, to decide which one to use for washing his clothes. He observes:
- Soap forms scum in hard water.
 - Detergent produces lather easily in hard water.

Which of the following inferences is correct? 1

- (a) Ca^{2+} and Mg^{2+} ions react with soap, forming insoluble compounds, whereas detergents do not form such insoluble salts.
- (b) Soap is acidic, and detergents are basic.

- (c) Soap react with Na^+ ions in hard water to form scum while detergents do not react with Na^+ ions.
 (d) Detergents form lather easily because they are ionic compounds and react with Ca^{2+} and Mg^{2+} ions while soaps do not react with hard water.

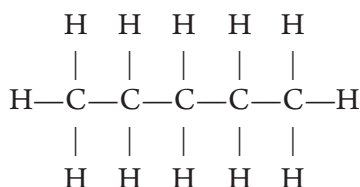
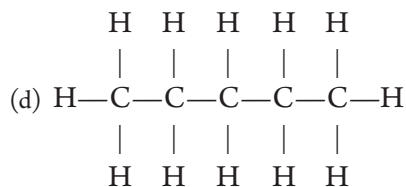
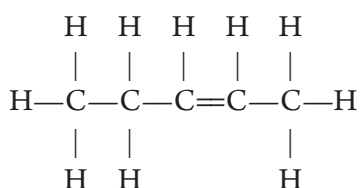
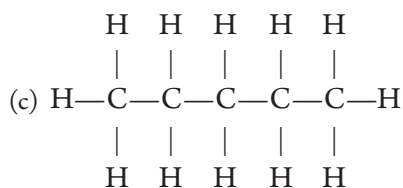
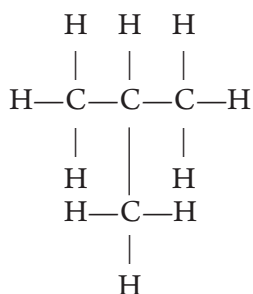
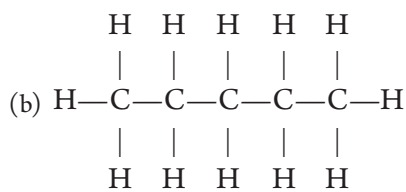
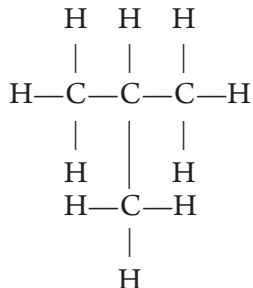
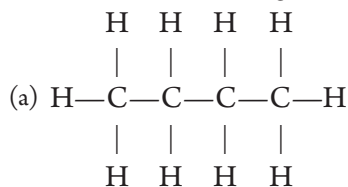
20. Which of the following salts contain water of crystallisation:

1

- (i) Plaster of Paris, (ii) Washing soda,
 (iii) Baking soda and (iv) Gypsum.
 (a) (i), (ii) and (iii) (b) (i), (iii) and (iv)
 (c) (ii), (iii) and (iv) (d) (i), (ii) and (iv)

21. Which of the following pair of compounds are isomers?

1



22. A food label is given below. E304 and E307b are added to the flavoured biscuits.

1



Which of the following is added to food packets for the same reason?

- (a) salt (b) vinegar (c) nitrogen (d) vanilla

23. Electrical wires made of aluminum

1

- (a) corrode easily as aluminium is a very reactive metal.
(b) corrode easily because porous flaky aluminium oxide is formed.
(c) do not corrode easily as aluminium oxide forms a protective layer.
(d) do not corrode easily as aluminium is less reactive than metals like sodium, magnesium and zinc.

The following question consists of two statements – Assertion (A) and Reason (R). Answer this question by 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, and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

24. **Assertion (A):** Onion extract loses its smell, when it is added to baking soda solution whereas it retains its smell when added to lemon juice.

Reason (R): Onion acts as an olfactory indicator.

1

25. Carbon forms millions of compounds whereas silicon, which is just below it in the Periodic Table, forms a few compounds. Explain the reason for the difference in their ability to form compounds.

2

26. Attempt either option (a) or (b).

3

- (a) An organic compound "X" with formula C_2H_6O is used to blend with petrol in order to reduce the dependence on fossil fuels and lower down the harmful emissions from the cars. It is also used as a solvent in medicines such as tincture iodine, cough syrups and many tonics.
- (i) Draw the electron dot structure of "X".
(ii) Write the name and formula of the next homologue of "X".
(iii) Write the reaction of "X" with acetic acid to form a sweet smelling substance.

OR

- (b) Ramya performs an experiment in the following two steps:

Step 1: Heats ethanol with conc. H_2SO_4 at 170°C to get product A.

Step 2: Passes hydrogen gas over product A, using Ni as a catalyst and gets product B.

- (i) Name the products A and B.
- (ii) Write the reactions involved in both the steps.

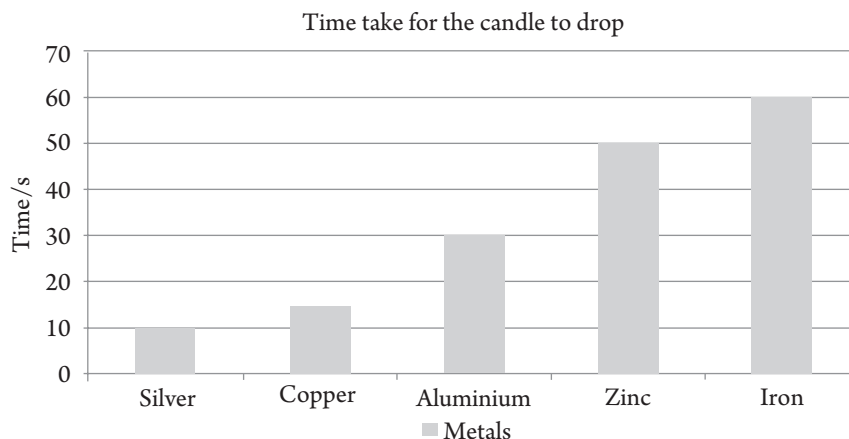
27. Give reason for the following:

3

- (a) A solution of sports electrolyte drink conducts electricity, but coconut oil does not.
- (b) Milkiness disappears when excess of carbon dioxide is passed through lime water.
- (c) An iron bridge near the sea rusts much faster than an iron bridge located in a dry hilly region.

28. Aavya and Vihan are studying the properties of metals in school. They decide to design and conduct an experiment to test the relative conduction of heat by metals. They use the apparatus (Figure) with rods of five different metals – aluminium, silver, copper, iron and zinc attached to a central point. This central point is heated using a burner. The metal rods are of equal length and thickness. They observe that the candles at the end of the rods fall at different times. (Study the graph)

4



- (a) On the basis of the graph obtained, which metal is the best conductor of heat?
- (b) Gold is a better conductor of heat than aluminium but it is not as good as copper. The time taken for the candle to drop if one of the rods were made of gold would have been:
 - (i) 15 s
 - (ii) 20 s
 - (iii) 35 s
 - (iv) 10 s

Attempt either sub-part (c) or (d).

- (c) The length of all the metal rods is increased by 20% without any change in the thickness. Will the time required for the candles to drop be affected? How and why?

OR

- (d) Mayank tries the experiment with an apparatus similar to figure (1). He ensures the length of all metal rods is the same. However, the thickness of rods is not the same in his apparatus. Will the inference he draws on the basis of his experiment be correct? Justify your answer.

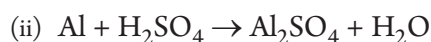
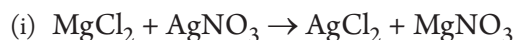
29. Attempt either option (a) or (b).

5

- (a) (i) Refer to the dialogue between Alisha, Drishti and Bhushan in the chemistry lab. They are discussing rusting of iron and formation of ammonia gas. Who all do you agree with and why?

- Alisha: The formation of ammonia by reaction of nitrogen with hydrogen is a reduction reaction.
- Drishti: Both rusting of iron and formation of ammonia are redox reactions.
- Bhushan: Rusting of iron is an oxidation reaction.

- (ii) Assess the following chemical equations. Identify the error(s) and rewrite the equation after correction.



OR

- (b) (i) Refer to the dialogue between Daljeet and Avik in the chemistry lab. They have learnt about decomposition reactions. Who has understood decomposition reactions correctly? Justify your answer.

Daljeet: During a decomposition reaction, a substance decomposes to give two simpler compounds. MgCO_3 decomposes on heating to magnesium oxide and carbon dioxide.

Avik: No, during a decomposition reaction, a substance decomposes to give two elements. Water on electrolysis gives hydrogen and oxygen, both are elements.

- (ii) Analyse the observations given in following two cases. Are these observations correct? Give reasons to support your answer.

- (i) Iron fillings are added to an aqueous solution of magnesium sulphate.

Observation: The colourless solution turns greenish due to formation of iron sulphate.

- (ii) Aluminium metal is added to dilute sulphuric acid.

Observation: Brisk effervescence are seen due to evolution of a gas.

Section C

30. A student wants to determine the focal length of a convex lens using sunlight. Which of the following practical procedures will give the most accurate result?

1

- (a) Move the lens close to a wall and measure the blurred circle.
- (b) Hold the lens above a sheet of paper and adjust until the smallest, brightest spot is formed.
- (c) Measure the thickness of the lens with a scale.
- (d) Look through the lens at a distant object.

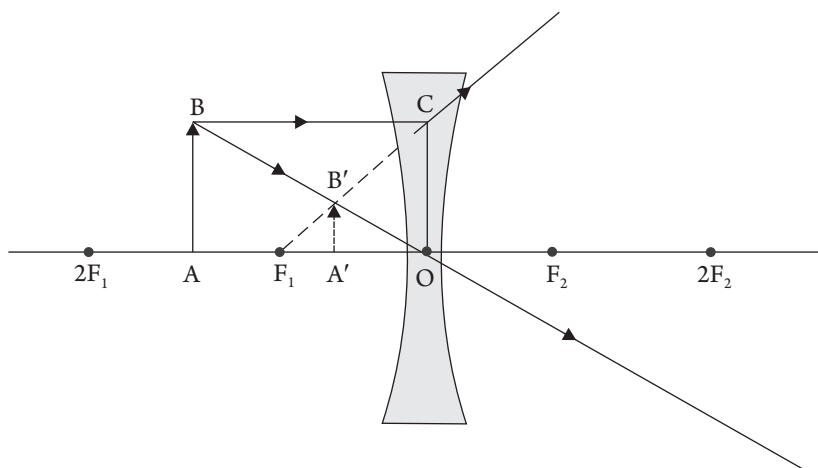
31. An electrical appliance rated 1000 W is operated at 250 V. What current does it draw? 1
- (a) 0.25 A (b) 2.5 A (c) 4.0 A (d) 10 A

The following one question consists of two statements – Assertion (A) and Reason (R). Answer this question by 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, and R is not the correct explanation of A.
 (c) A is true but R is false.
 (d) A is false but R is true.
32. **Assertion (A):** The apparent depth of a coin in water is less than its real depth. 1
Reason (R): Light bends away from the normal when it travels from water to air.
33. (a) State Snell's Law of refraction.
 (b) Define the refractive index of a material with respect to another material giving the mathematical expression.
34. *Attempt either option (a) or (b).* 2
- (a) (i) State Joule's Law of heating.
 (ii) What happens to the heat produced in a conductor if the resistance is doubled while keeping other variables constant?

OR

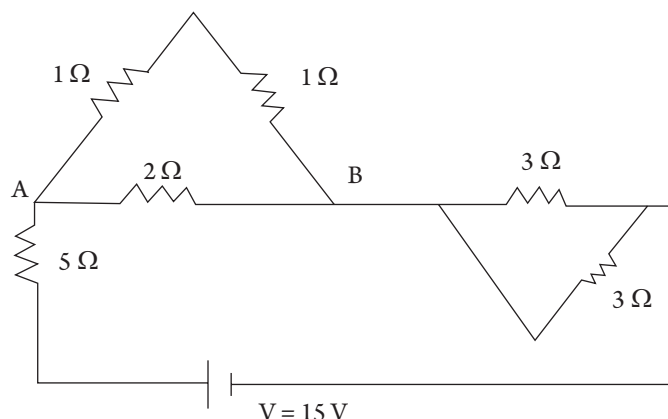
- (b) (i) Define resistivity.
 (ii) Justify with an example why resistivity is an intrinsic property of a material.
- 35.



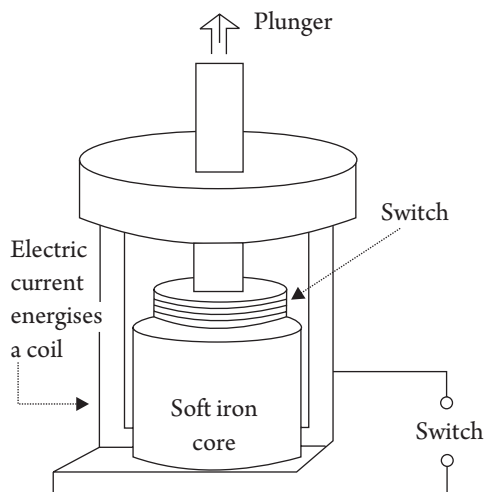
A concave lens forms an image that is $1/3$ rd the size of the object, as shown in the diagram. If the object is placed 24 cm in front of the lens, determine: 3

- (a) the type of lens.
 (b) the image distance.
 (c) the focal length of the lens.

36. (a) State the Right-Hand Thumb Rule and describe how it helps determine the direction of magnetic field around a current-carrying conductor. 3
 (b) Explain how the magnetic field changes with distance from the conductor. 3
 37. The figure shows a circuit with a 15 V battery connected to several resistors. 3



- (a) Find the total current supplied by the battery.
 (b) Calculate the potential difference between points A and B.
 38. A school has installed an automatic electromagnetic door-locking system at the main entrance. The locking mechanism uses a solenoid controlled by a switch at the security desk. When electricity flows through the solenoid, it creates a magnetic field strong enough to pull an iron bolt, unlocking the door. As soon as the switch is turned off, the magnetic field disappears, and a spring pushes the bolt back, locking the door. 4



- (a) Why is an iron core kept inside the solenoid in this locking mechanism?
 (b) How can we determine the magnetic poles in this solenoid?
Attempt either subpart (c) or (d).
 (c) If the current in the solenoid is increased from 1 A to 2 A, explain how the magnetic effect changes and its effect on unlocking the door.

OR

- (d) If the source of the current is fixed, how can we increase the magnetic field in the solenoid?

39. Attempt either option (a) or (b).

5

- (a) (i) What is meant by accommodation of the human eye?
- (ii) What is the near point of a normal eye and what does it signify?
- (iii) Name which type of lens is used to correct the defect in which a person cannot see distant objects clearly.
- (iv) Draw a diagram to show how the choice of your lens in (iii) helps to see distant objects clearly?

OR

- (b) (i) What is dispersion of light?
- (ii) Which colour of light deviates the least during dispersion through a prism?
- (iii) State why the sky appears dark to an astronaut in outer space.
- (iv) Draw a simple labelled diagram to show how white light splits into different colours while passing through a glass prism.

ANSWERS

Section A

1. (a) Carbon dioxide is reduced during photosynthesis by gaining hydrogen, while water is oxidised and loses electrons.
2. (c) In set-up R, lime water is expected to be the cloudiest.
3. (a) Glucose and useful salts are selectively reabsorbed from the filtrate back into the blood during urine formation.
4. (c) Removing the anthers prevents self-pollination, and bagging prevents pollen from another flower from reaching the stigma.
5. (c) Both vasectomy and tubectomy procedures block the transport pathways of gametes, so the male and female gametes cannot meet and fuse.
6. (b) Gametes are haploid, so both male and female gametes contain 17 chromosomes; the adult plant is diploid with 34 chromosomes.
7. (c) The larvae feed on producers and are primary consumers; the fish feeds on the larvae, so it is a secondary consumer.
8. (d) The assertion is false because aquatic organisms generally breathe faster to obtain enough oxygen; the reason is true because water contains less dissolved oxygen than air.
9. (d) The assertion is false: about 10% of energy is transferred to the next trophic level, not 1%. The reason is true.
10. (a) The bile juice from the liver makes the food alkaline for the pancreatic enzymes to act. In addition, bile salts break down fats into smaller globules increasing the efficiency of enzyme action. If the bile duct is obstructed, it can lead to improper digestion of fats.
(b) Herbivores eating grass need a longer small intestine to allow the cellulose to be digested. Meat is easier to digest, hence carnivores like tigers have a shorter small intestine.
11. (a) The actions on which we do not have any thinking control are controlled by the mid-brain and hind-brain. These are called involuntary actions. Examples, blood pressure, salivation etc.
OR
(b) The information of touch is communicated by electrical-chemical means from cell to cell. Plant cells change shape by changing the amount of water in them, resulting in swelling or shrinking, thus changing shapes and causing movement.
12. The following changes occur in the uterus after implantation of the young embryo in a human female:
Uterine lining thickens and is richly supplied with blood vessels to nourish the embryo.
Placental connection is developed between the uterus and embryo.
13. When the brain sends a processed nerve signal to a muscle, the signal reaches the muscle fibres through motor nerves. This causes the muscle fibres to contract, as the proteins actin and myosin slide past each other, shortening the muscle fibre. The contraction produces a pull on the attached bones, resulting in movement. When the signal stops, the muscle relaxes, allowing the body part to return to its position.
14. (a) The fourth trophic level has 10 kJ. By the 10% law, each lower trophic level must have ten times as much energy: third level = 100 kJ, second level = 1,000 kJ, and producer level = 10,000 kJ. Therefore, the energy available at the producer level is 10,000 kJ.
(b) No. At every transfer only a small fraction of energy is available to the next trophic level. After several transfers, too little usable energy remains to support additional trophic levels.

- (c) The large fish will contain the maximum amount of pesticide because non-biodegradable pesticides undergo biological magnification and become progressively more concentrated at higher trophic levels.
15. (a) In experiment one, in F_1 all plants (100%) will have violet (Vv) flowers and in F_2 , 75% (3/4) plants will have violet flowers (1/4 VV and 2/4 Vv) because violet colour of the flower is a dominant trait in pea plant.
- (b) 3/16 or 18.75% pea plants will have tall height and white flowers (vvTT/vvTt) – a combination of a dominant and a recessive trait. It is caused by the independent assortment of alleles.
- (c) In pea plants, no halfway characteristics are produced because even a single copy of T or V will produce the same result as two copies of T or V. Thus, no plants with medium height and light violet flowers will be produced in F_1 or F_2 generation (zero percent).

OR

- (d) In F_1 generation all plants will have only dominant traits so no plant with short height and white flowers (recessive traits) will be produced (zero percent). In F_2 generation 1/16 or 6.25 % plants will have short height with white flowers (vvtt) as both these traits are recessive.
16. (a) (i) Image C depicting four-chambered heart is present in both birds and mammals.
- The separation of the right side and the left side of the heart is useful to keep oxygenated and deoxygenated blood from mixing. Such separation allows a highly efficient supply of oxygen to the body. This is useful in animals that have high energy needs, such as birds and mammals, which constantly use energy to maintain their body temperature.
- (ii) Image A showing two-chambered heart is present in fishes.
- The blood is pumped to the gills, is oxygenated there, and passes directly to the rest of the body. Thus, blood goes only once through the heart in the fish during one cycle of passage through the body.

OR

- (b) (i) Image A depicts inhalation process
- The process of inhalation has the following steps:
- Ribs get lifted → Diaphragm is flattened → The chest cavity becomes larger → Air is sucked in
- (ii) In human beings, the respiratory pigment haemoglobin has a very high affinity for oxygen. This pigment is present in the red blood corpuscles. This oxygen-rich blood is then pumped by the heart to the rest of the body.

Section B

17. (c) physical change because the space between crystals is adjusted.
- Only the spacing between the light-reflecting crystals changes. No new substance is formed, so the change is physical.
18. (b) I and III. Statements I and III are correctly matched: hydrogen is formed at the cathode and sodium hydroxide is obtained near the cathode in the chlor-alkali process. II and IV are incorrect as chlorine is produced at the anode, but it is not used to make margarine. Sodium hydroxide is deposited near cathode.
19. (a) Ca^{2+} and Mg^{2+} ions react with soap, forming insoluble compounds, whereas detergents do not form such insoluble salts.

Calcium and magnesium ions in hard water form insoluble salts with soap (scum), whereas detergents do not form such insoluble salts.

20. (d) (i), (ii) and (iv).

Plaster of Paris is $\text{CaSO}_4 \cdot 1/2 \text{H}_2\text{O}$, Washing soda $\text{Na}_2\text{CO}_3 \cdot 10 \text{H}_2\text{O}$ Baking soda NaHCO_3 and Gypsum is $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. Plaster of Paris, washing soda and gypsum contain water of crystallisation; baking soda does not.

21. (a) The compounds in this pair have same molecular formula but different structural formula.

The correct pair has the same molecular formula but different structural formulae, which is the defining feature of structural isomers.

22. (c) Nitrogen. In the label E304 and E307b are antioxidants. Nitrogen is also used as an antioxidant.

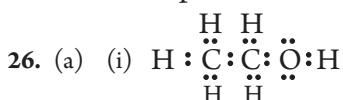
- 23 (c) Do not corrode easily as aluminium oxide forms a protective layer.

Aluminium forms a thin, adherent aluminium oxide layer that protects the metal beneath from further corrosion.

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

Explanation: The assertion and reason are both true, but the statement that onion is an olfactory indicator does not by itself explain the full acid-base behaviour stated in the assertion.

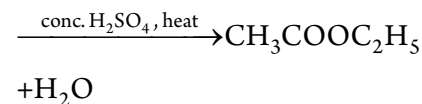
25. Carbon forms millions of compounds because it has small atomic size, therefore, it forms strong and stable C–C bonds, showing extensive catenation. Silicon, being larger in size, forms weaker Si–Si bonds and cannot show catenation to the same extent, so it forms fewer compounds.



- (ii) Name of compound X: Ethanol ($\text{C}_2\text{H}_5\text{OH}$)

Formula of the next homologue: Propanol ($\text{C}_3\text{H}_7\text{OH}$)

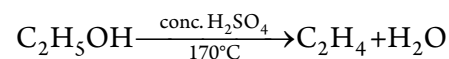
- (iii) $\text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{COOH}$



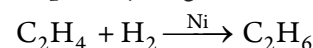
OR

- (b) (i) Product A – Ethene, Product B – Ethane

- (ii) Step 1: Dehydration of ethanol

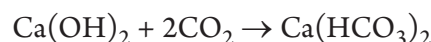


Step 2: Hydrogenation of ethene



27. (a) A sports electrolyte drink conducts electricity because it contains dissolved ions that can move freely and carry electric current. Coconut oil is a non-electrolyte and does not produce free ions.

- (b) Passing excess carbon dioxide through lime water forms soluble calcium hydrogen carbonate, which dissolves in water. Hence, the milkiness disappears.



- (c) An iron bridge near the sea rusts faster because moisture and dissolved salts in sea air increase the rate of corrosion. Dry hilly regions have much less moisture and salt-laden air.

28. (a) Silver is the best conductor of heat because it takes the least time (10 seconds) for the candle to drop.

- (b) (ii) 20 s, Reason: Since gold is a better conductor than aluminium (30 s) but not as good as copper (15 s), the time taken for gold must lie between 15 seconds and 30 seconds.

- (c) Yes, the time required for candles to drop will increase for all the metals. The order of falling of candles will remain the same.

Particles vibrate and transfer heat to one another in conduction. Conduction of heat will take more time to travel from one end to the other as longer distance has to be covered by heat energy.

OR

- (d) No, if the thickness of rods is changed the inference will not be correct.

The dimensions of the rods have to be the same. A thicker rod will take more time to conduct heat.

29. Student to attempt either option (a) or (b).

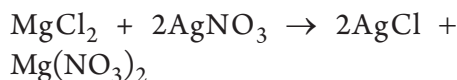
- (a) (i) Drishti is correct. Alisha and Bhushan are partially correct.

Oxidation and reduction go hand in hand. In case of formation of ammonia, nitrogen is getting reduced and hydrogen is oxidised. In case of rusting of iron, iron is getting oxidised while oxygen gets reduced.

- (ii) (i) $\text{MgCl}_2 + \text{AgNO}_3 \rightarrow \text{AgCl}_2 + \text{MgNO}_3$
Errors:

- Silver ion is Ag^+ , so silver chloride is AgCl , not AgCl_2 .
- Magnesium ion is Mg^{2+} , so magnesium nitrate is $\text{Mg}(\text{NO}_3)_2$, not MgNO_3 .
- The equation must be balanced.

Correct equation:

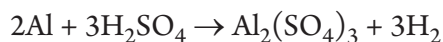


- (ii) $\text{Al} + \text{H}_2\text{SO}_4 \rightarrow \text{Al}_2\text{SO}_4 + \text{H}_2\text{O}$

Errors:

- Aluminium sulfate is $\text{Al}_2(\text{SO}_4)_3$, not Al_2SO_4 .
- The reaction of aluminium with dilute sulphuric acid produces hydrogen gas, not water.
- The equation must be balanced.

Correct equation:



OR

- (b) (i) Both have understood decomposition partially.

Decomposition reaction is when a single substance breaks down into simpler substances. The single substance undergoing decomposition has to be a compound while the products formed can be either elements or compounds. MgCO_3 decomposes on heating to magnesium oxide and carbon dioxide even when both products formed are compounds, it is decomposition.

Water on electrolysis gives hydrogen and oxygen both are elements. It is also a decomposition reaction.

- (ii) (i) Incorrect observation, iron is less reactive than Mg so it cannot displace magnesium.
(ii) Hydrogen gas is formed, which produces few bubbles. Brisk effervescence is formed when carbon dioxide is formed.

Section C

30. (b) Hold the lens above a sheet of paper and adjust until the smallest, brightest spot is formed.

For a distant object such as the Sun, a convex lens forms a sharp image approximately at its focal plane; the smallest, brightest spot therefore gives the best focal-length estimate.

31. (c) 4.0 A

Using $P = VI$, the current is

$$I = \frac{P}{V} = \frac{1000}{250} = 4.0 \text{ A.}$$

32. (a) Both A and R are true, and R is the correct explanation of A.

On moving from water to air, light bends away from the normal. This refraction makes the coin appear raised, so its apparent depth is less than its real depth.

33. (a) **Snell's law:** For a given colour of light and a given pair of media, the ratio $\sin i / \sin r$ is constant.

(b) If light travels from medium 1 to medium 2 with speeds v_1 and v_2 respectively, the refractive index of medium 2 with respect to medium 1 is given in the marking scheme as $n_{21} = \frac{v_2}{v_1}$.

34. (a) Joule's law of heating states that the heat produced in a resistor is directly proportional to the square of the current, the resistance, and the time for which current flows: $H = I^2 R t$.

(b) If resistance is doubled while current and time remain constant: $H' = I^2 (2R) t$
 $= 2I^2 R t = 2H$.

Hence, the heat produced doubles.

OR

(a) Resistivity (ρ) is the resistance of a conductor of unit length and unit cross-sectional area.

For a wire, $R = \frac{\rho L}{A}$.

(b) Resistivity is an intrinsic property because it depends on the material, not on the dimensions of the sample. Two copper wires of different lengths and thicknesses yield the same ρ when calculated from $\rho = \frac{RA}{L}$.

35. (a) Given object distance $u = -24$ cm. The lens is a concave (diverging) lens.

(b) Magnification $m = \frac{h_i}{h_o} = \frac{v}{u}$. Since the image

is upright and one-third the size of the object, $m = \frac{+1}{3}$. Therefore, $v = mu$

$= \left(\frac{1}{3}\right)(-24 \text{ cm}) = -8 \text{ cm}$. The negative

sign shows that the image is virtual and lies 8 cm from the lens on the same side as the object.

(c) Lens formula:

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

Substituting $v = -8$ cm and $u = -24$ cm:

$$\frac{1}{f} = \frac{-1}{8} + \frac{1}{24} = \frac{(-3+1)}{24} = \frac{-2}{24} = \frac{-1}{12}.$$

Hence, $f = -12$ cm.

36. (a) **Right-Hand Thumb Rule:** Imagine that you are holding a current-carrying straight conductor in your right hand such that the thumb points towards the direction of current. Then your fingers will wrap around the conductor in the direction of the field lines of the magnetic field. If the thumb of the right hand points in the direction of conventional current, the curled fingers indicate the direction of the magnetic field lines around the conductor. This helps determine the direction of the magnetic field.

(b) **Variation with distance:** Magnetic field magnitude around a long straight conductor at distance r falls as

$$B \propto \frac{1}{R},$$

i.e. it decreases inversely with distance from the conductor.

37. (a) The two 1Ω resistors between A and B are in series, so their equivalent resistance is 2Ω . This 2Ω combination is in parallel with the 2Ω resistor directly between A and B: $\frac{1}{R_{AB}} = \frac{1}{2} + \frac{1}{2}$, so $R_{AB} = 1 \Omega$. The

two 3Ω resistors on the right are in parallel, giving 1.5Ω . Hence total resistance $= 5 \Omega + 1 \Omega + 1.5 \Omega = 7.5 \Omega$.

Using $V = IR$, $I = \frac{15}{7.5}$

$= 2 \text{ A}$.

(b) Between A and B,

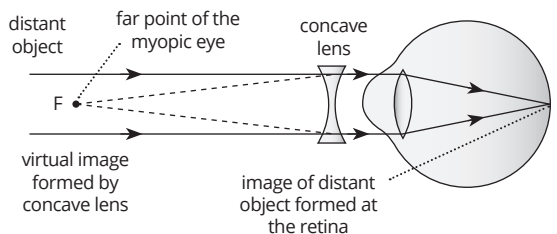
$$V_{AB} = I \times R_{AB} = 2 \text{ A} \times 1 \Omega = 2 \text{ V}.$$

38. (a) An iron core placed inside the solenoid concentrates and amplifies the magnetic field, producing a stronger pulling force on the bolt.
- (b) Using the right-hand thumb rule (Curl the fingers of your right hand in the direction of current, then the direction of thumb will point towards the direction of north pole of the solenoid) Use a bar magnet with a known north pole towards one of the ends of the solenoid, Repulsion will indicate North pole.
- (c) If current increases then the magnetic field B inside a solenoid will also increases as magnetic field is directly proportional to current.
- (d) Increase the number of turns N of the coil, reduce coil length, or insert a soft iron core. (any two points)
39. (a) (i) **Accommodation:** Ability of the eye lens to change its focal length to focus objects at different distances on the retina.
- (ii) **Near point:** The nearest point (about 25 cm for a normal eye) at which

an object can be seen distinctly; it signifies the closest comfortable focus.

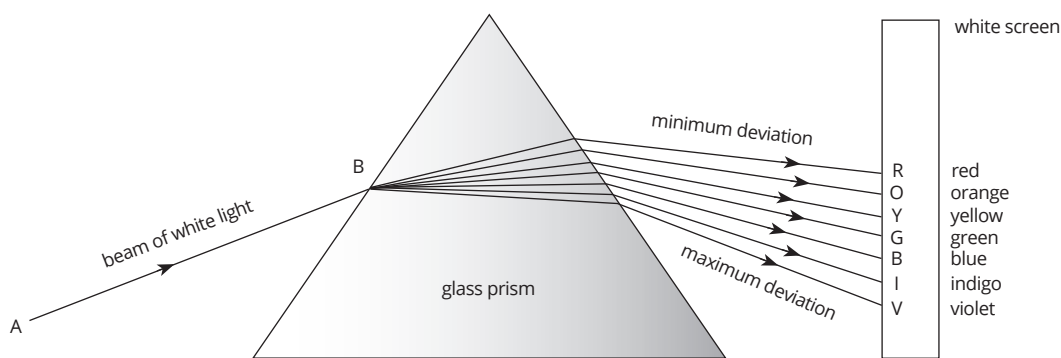
- (iii) **Lens for defect (cannot see distant objects):** A diverging (concave) lens is used to correct myopia (short-sightedness).

- (iv) **Diagram:**



Correction for myopia

- (b) (i) **Dispersion:** Splitting of white light into its component colours due to wavelength-dependent refraction.
- (ii) **Colour deviating least in prism:** Red deviates least (longest wavelength).
- (iii) **Sky dark in space:** No atmosphere to scatter sunlight – space appears dark.
- (iv) **Diagram:**



A glass prism splits the white light into seven colours.