Competency Based Practice Questions

Science - X

Co-created by

Board of School Education Haryana
and
Educational Initiatives

HOW TO USE THIS BOOKLET

Dear Teachers and Students,

The **Board of School Education Haryana** is pleased to present the **Competency-Based Practice Questions** booklet. This resource has been thoughtfully designed to help you deepen your understanding of key concepts and enhance your problem-solving skills. It includes **50 exemplar questions** carefully aligned with the curriculum to familiarize students with the format of **Competency-Based Questions**. These questions are intended to support targeted practice and develop the skills necessary to confidently approach a variety of question types in assessments.

Best Ways for Teachers to Utilise This Resource

1. Integrate into Classroom Teaching

- Use these questions to demonstrate how theoretical concepts translate into practical applications.
- Encourage group discussions to explore reasoning and understanding of concepts taught.

2. Scaffold Student Learning

- Start with simpler questions and guide students through the thought process.
- Gradually introduce more complex questions to build confidence and familiarity.

3. Incorporate into Assessments

- Use these questions in classroom quizzes or homework to help students adapt to the format.
- Provide feedback that emphasises reasoning over correctness, encouraging students to refine their understanding.

4. Focus on Skill Development

- Highlight how these questions nurture understanding, analysis and critical thinking.
- Use student responses to identify and address misconceptions effectively.

Best Ways for Students and Parents to Utilise This Resource

1. Focus on Conceptual Understanding

- Approach each question as a way to understand *why* and *how* a concept works, rather than simply finding the correct answer.

2. Practice Purposefully

- Don’t rush—break down the question, identify the concept it addresses, and plan your approach before solving it.

3. Use Feedback to Improve

- Treat mistakes as learning opportunities. Review incorrect answers to understand *what went wrong* and *how to improve*.
- Revisit similar questions to build confidence and mastery over the topic.

Best Ways for Parents to Utilise This Resource

1. Encourage Critical Thinking

- Spend time discussing questions and concepts, asking “Why?” and “How?”.

2. Create a Positive Environment

- Celebrate effort and curiosity, not just grades.
- Help your child view mistakes as opportunities to learn and grow.

3.Collaborate with Teachers

- Stay informed about competency-based assessments through school communications.
- Share observations and work with teachers to address any concerns or challenges.

Final Message

These practice questions are an excellent opportunity to strengthen your conceptual understanding and boost your confidence in solving competency-based questions. For students, each question builds skills that will help you tackle similar challenges with ease. For teachers, this is a chance to mentor students in developing their thinking and problem-solving skills.

Start today—every effort you invest will prepare you not only for exams but for a lifetime of meaningful learning and success. Let’s make this journey toward competency-based education a meaningful and successful one!

Board of School Education, Haryana

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Science | Class X

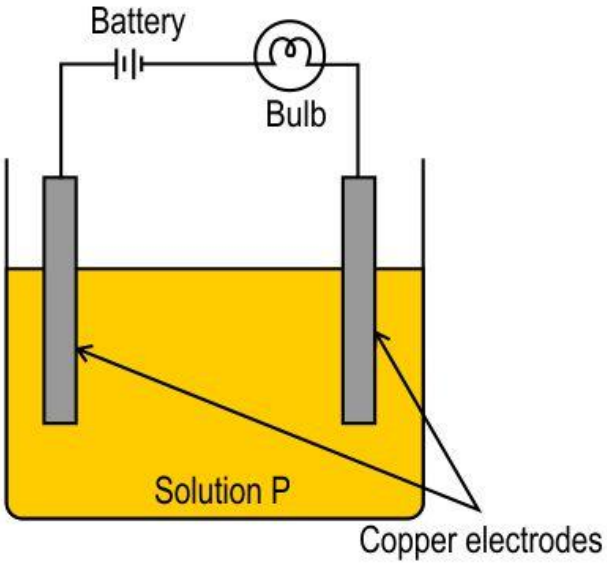
Chemical Reactions and Equations

Q.No.	Question	Marks
1	The reactants in four chemical reactions are given below. In which of the reactions will the number of molecules of the product(s) formed be LESSER than the number of molecules of reactants? (A) Barium chloride (aq) + copper sulphate (aq) -----> (B) Zinc (s) + copper sulphate (aq) -----> (C) Quicklime (s) + water (l) ------> (D) Limestone (s) $\xrightarrow{\text{Heat}}$ ***[Skill: Understanding]***	1
2	Identify the type of the following reaction based on the energy change occurring during the reaction. $NaOH + HCl$ -----> $NaCl + H_2O$ ***[Skill: Mechanical]***	1
3	(a) Explain how a balanced equation can be identified. (b) Given below are two equations. (i) $CH_4 + O_2$ ---> $CO_2 + H_2O$ (ii) $Na_2O + 4\ H_2O$ ---> $2\ NaOH$ Which of the two equations is/are NOT balanced? Rewrite the balanced equation(s). ***[Skill: Understanding]***	1+2
4	(a) Balance the following chemical reactions and identify the type of reaction. $Fe + H_2O$ ------> $Fe_3O_4 + H_2$ $CO_2 + H_2O$ ------> $C_6H_{12}O_6 + O_2$ (b) Write the states of the reactants and the products in the two reactions. ***[Skill: Understanding]***	4+1

Marking Scheme

Q No.	Rubric	Marks
1	**Correct Answer:** C One molecule of quicklime reacts with one molecule of water to give one molecule of slaked lime.	1
	A: Students choosing this may have missed that one molecule of barium chloride reacts with one molecule of copper sulphate to give one molecule of barium sulphate and one molecule of copper chloride.	
	B: Students choosing this may have missed that one atom of zinc reacts with one molecule of copper sulphate to give one molecule of zinc sulphate and one atom of copper.	
	D: Students choosing this may have missed that one molecule of limestone decomposes on heating strongly to give one molecule of quicklime and one molecule of carbon dioxide.	
2	exothermic	1
3	(a) The number of atoms of each element should be the same on the left hand side and on the right hand side.	1
	(b) Both equations are not balanced. *[1 mark]* Balanced equation: $CH_4 + 2\ O_2$ ---> $CO_2 + 2\ H_2O$ *[0.5 marks]* $Na_2O + H_2O$ ---> 2 NaOH *[0.5 marks]*	2
4	3 Fe + 4 H_2O ------> $Fe_3\ O_4 + 4\ H_2$ *[1 mark]* Displacement reaction *[1 mark]* *[Marks to be given for any other correct answer.]* 6 CO_2 + 6 H_2O ------> $C_6H_{12}O_6 + 6\ O_2$ *[1 mark]* Endothermic reaction *[1 mark]* *[Marks to be given for any other correct answer.]*	4
	Fe(s) + H_2O(g)------> $Fe_3\ O_4$(s) + H_2 (g) *[0.5 marks]* CO_2 (g) + H_2O (l)------> $C_6H_{12}O_6$ (aq) + O_2 (g) *[0.5 marks]*	1

Acids, Bases and Salts

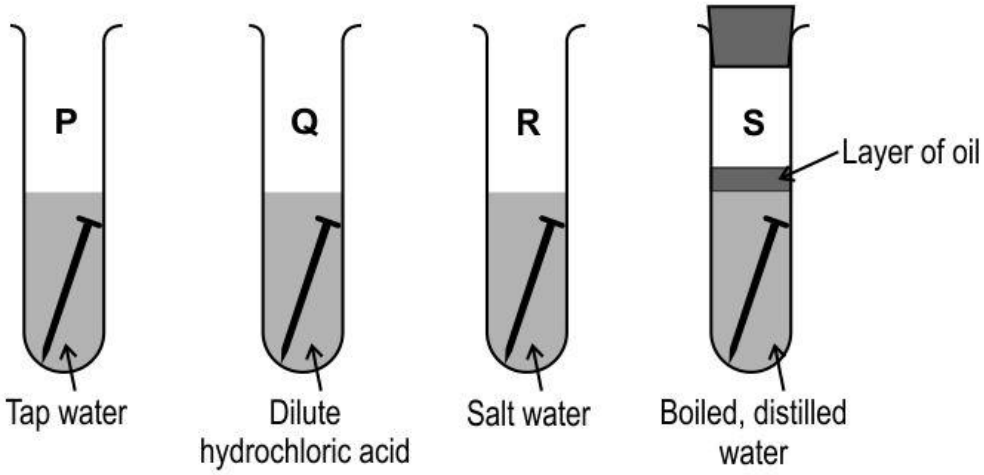
Q.No.	Question	Marks
5	A salt 'X' is used for faster cooking. It is mild, non-corrosive, and basic. Which of the following sets of chemicals is most likely to produce salt 'X'? (A) Sodium carbonate and hydrochloric acid (B) Sodium hydroxide and hydrochloric acid (C) Sodium chloride, water, carbon dioxide, and ammonia (D) Sodium chloride, water, hydrochloric acid, and carbon dioxide ***[Skill: Mechanical]***	1
6	Ashok arranged a setup as shown below.  The bulb glows when the two copper electrodes are in contact with each other, but does NOT glow when they are placed in the solution P in the setup above. (a) What could be the most probable reason for the bulb not glowing in the setup above? (b) What would you observe if solution P in the beaker is replaced with an aqueous solution of: (i) potassium hydroxide (ii) acetic acid? ***[Skill: Understanding]***	1+1
7	Dilute sulphuric acid reacts with an oxide to produce a salt and water. (a) State whether the oxide is a metallic or non-metallic oxide. Justify your answer. (b) Give one example each of a metallic oxide and a non-metallic oxide. ***[Skill: Understanding]***	2+1

8	(a) Suggest a test using an indicator to find out if dry HCl gas is acidic or neutral? (b) What would be the observation made in the test suggested in (a)? (c) A gas is produced on passing dry HCl gas through a mixture of zinc granules and water in a test tube. (i) Write the word equation for the reaction occurring. (ii) Suggest a test to identify the gas produced. ***[Skill: Application]***	1+2+2

Marking Scheme

Q No.	Rubric	Marks
5	**Correct Answer:** C Reacting these four chemicals together gives baking soda which is used for faster cooking, is mild, non-corrosive and basic in nature.	1
	A: Students choosing this may have missed that this pair of compounds on reaction, produce NaCl, CO_2, and H_2O as the products.	
	B: Students choosing this may have missed that the salt produced with this set of chemicals is NaCl.	
	D: Students choosing this may have missed that ammonia is replaced by hydrochloric acid in this set of reactants.	
6	(a) The bulb does not glow due to the absence of ions in solution P. *[Award marks for any other correct answer.]*	1
	(b-i) The bulb will glow with aqueous potassium hydroxide. *[0.5 marks]* (b-ii) The bulb will glow with aqueous acetic acid. *[0.5 marks]*	1
7	(a) - metallic oxide *[1 mark]* 1 mark for the justification: - Since the oxide reacts with an acid, it is basic in nature. OR - Metallic oxides are basic in nature.	2
	(b) 0.5 marks each for one example of a metallic oxide and one example of a non-metallic oxide Metallic oxide: copper oxide; zinc oxide Non-metallic oxide: carbon dioxide; sulphur dioxide *[Marks to be given for any other valid example.]*	1
8	(a) Test its reaction to dry red litmus paper and to dry blue litmus paper. *[Marks to be awarded for any other valid answer.]*	1
	(b) 1 mark each for the following: • dry red litmus paper would remain red • dry blue litmus paper would remain blue *[Marks to be awarded for any other valid answer.]*	2
	(c-i) Hydrochloric acid + Zinc -----> zinc chloride + hydrogen *[1 mark]* (c-ii) The gas burns with a 'pop' sound on bringing a lighted splint near the mouth of the test tube. *[1 mark]*	2

Metals and Non-metals

Q.No.	Question	Marks
9	Articles made of iron on exposure to air get coated with rust, which is iron oxide. An iron nail is placed in each of the test tubes shown below.  In which of the test tubes will the iron nail get coated with rust? (A) only P (B) only P and R (C) only P, Q, and R (D) all - P, Q, R, and S ***[Skill: Understanding]***	1
10	Fill in the blank in the following sentence. 'Among all metals, 1 g of gold can be drawn into the greatest length of wire because gold is the most _____ of all metals.' ***[Skill: Mechanical]***	1

11	Given below is the reaction of three metals P, Q, and R with water. - P does not react with cold water, but reacts with hot water to form the metal hydroxide and hydrogen. - Q reacts violently with cold water to form the metal hydroxide and hydrogen. - R does not react with hot water, but reacts with steam to form the metal oxide and hydrogen (a) Based on their reactions with water, arrange the three metals in the decreasing order of their reactivity. Justify your answer. (b) Which of the metals can displace P from a solution of its salt? Give a reason for your answer. ***[Skill: Understanding]***	2+1
12	(a) Identify the type of chemical reaction occurring when a copper vessel turns black on being heated strongly. Write the balanced equation for the reaction. (b) To clean a copper vessel that had turned black, Samta rinsed it with dilute hydrochloric acid and Udita rinsed it with hot water. (i) The black coating was removed from only one of the vessels. Whose vessel was it? Justify your answer. (ii) What will be the colour of the rinsing solution in which the vessel gets cleaned? (c) Samta's mother said that the dilute hydrochloric acid would corrode the copper vessel. Is her mother correct? Explain. ***[Skill: Application]***	1.5+2+1.5

Marking Scheme

Q No.	Rubric	Marks
9	**Correct Answer:** B Iron rusts in the presence of moisture and air. These conditions are present in test tubes P and R.	1
	A: Students choosing this option may be influenced by their observation that iron objects placed in water, rust. They may have missed that salt water also gives the conditions for rusting.	
	C: Students choosing this option may have missed that in test tube Q, any rust formed will immediately react with the dilute hydrochloric acid.	
	D: Students choosing this option may have missed that the conditions required for rusting are not present in test tubes Q and S.	
10	ductile	1
11	(a) • Q > P > R *[1 mark]* • Since metal Q reacts with cold water, it requires the least energy and is the most reactive. • Since metal R reacts only with steam, it is the least reactive. • Since metal P reacts with hot water it requires energy between that of Q and R and hence its reactivity is in between Q and R. *[1 mark for correct reason]*	2
	(b) Metal Q *[0.5 marks]* Metal Q is more reactive than metal P and hence can displace it from its salt solution. *[0.5 marks]*	1
12	(a) oxidation *[0.5 marks]* $2\ Cu + O_2$ ----> $2\ CuO$ *[1 mark]* *[Marks to be given for any other correct answer.]*	1.5
	(b-i) The black coating will be removed from Samta's vessel. *[0.5 marks]* The black coating formed on the copper vessel is copper oxide which is a metallic oxide. *[0.5 marks]* Metallic oxides are basic in nature and hence react with acids, forming a salt and water. *[0.5 marks]* (b-ii) The solution will be blue in colour. *[0.5 marks]*	2
	(c) Samta's mother is incorrect. *[0.5 marks]* Copper does not react with hydrochloric acid as it is less reactive than hydrogen. *[1 mark]*	1.5

Carbon and its Compounds

Q.No.	Question	Marks
13	The question below consists of two statements, Assertion (A) and Reason (R). Answer the questions by selecting the appropriate option given below. Assertion (A): A single carbon atom can form double bonds with two oxygen atoms. Reason (R): Carbon has a valency of four. (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 and R is false. (D) A is false and R is true. ***[Skill: Understanding]***	1
14	Which of these compounds have the same number of hydrogen atoms? propanol, propanal, propanone (A) propanol and propanal (B) propanol and propanone (C) propanal and propanone (D) (none of them) ***[Skill: Understanding]***	1
15	Hexene is an alkene having the formula C_6H_{12}. A saturated hydrocarbon with the same formula as hexene, but without any double bonds, has its carbon atoms arranged in the form of a _____. ***[Skill: Understanding]***	1
16	(a) Write the reaction for the saponification of the ester formed from ethanoic acid and ethanol. (b) Which of the compounds in the reaction in answer (a) is chemically similar to soap? ***[Skill: Mechanical]***	1+1

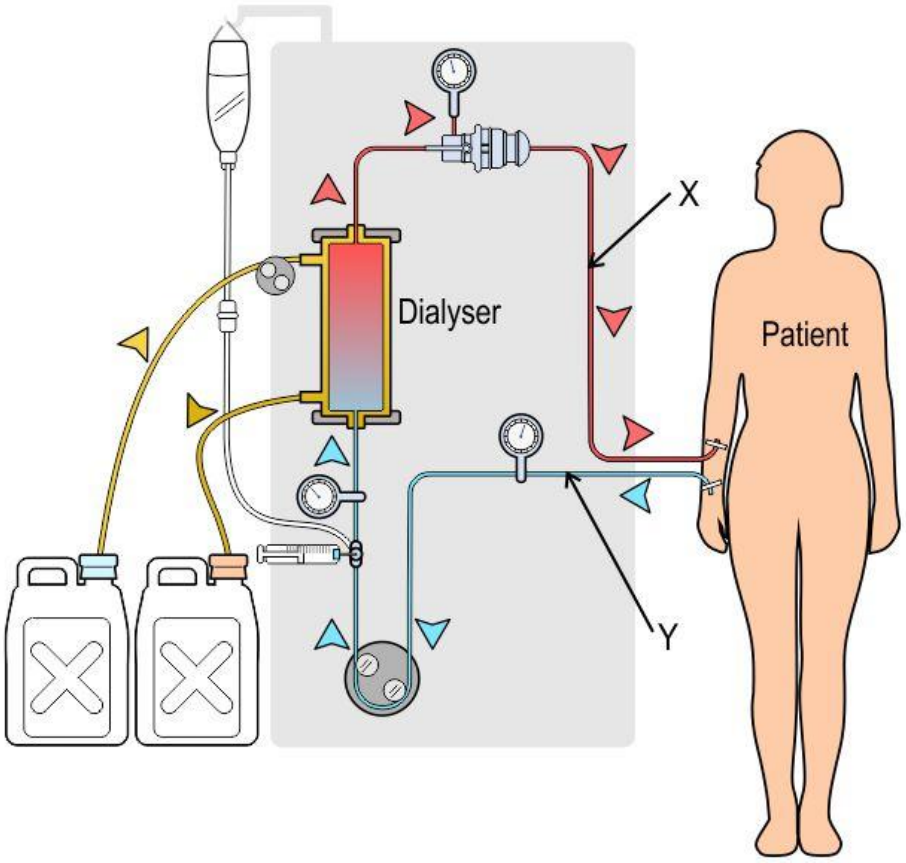
17	A hydrocarbon has one C=C bond in its molecule. (a) How many electrons are shared between these two carbon atoms? (b) Write the general formula for the homologous series of such compounds. (c) Give the structure of the second member of this homologous series. (d) Write the structure of the compound that is formed when the compound given in answer (c) is reacted with hydrogen in the presence of nickel. (e) Describe the type of flame that is produced on burning hydrocarbon compounds that have a C = C in them. ***[Skill: Mechanical]***	1+1+ 1+1+ 1

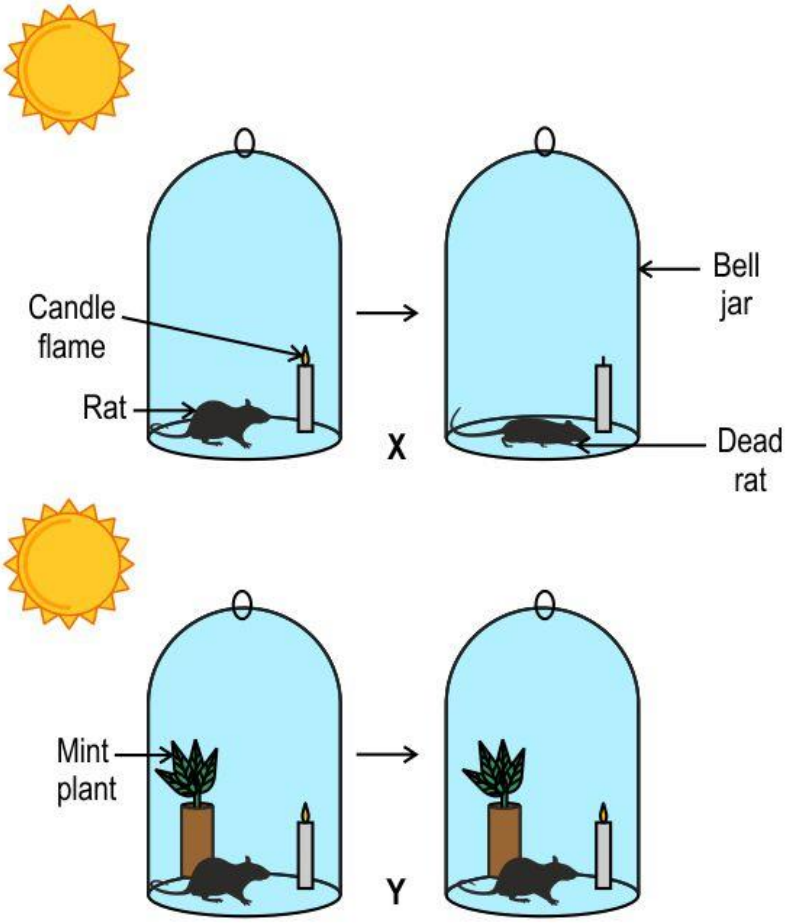
Marking Scheme

Q No.	Rubric	Marks
13	**Correct Answer:** A A carbon atom is tetravalent and needs 4 electrons to form a stable octet. It can therefore form a double bond with two oxygen atoms.	1
	B: Students choosing this may have missed that a carbon atom is tetravalent and needs 4 electrons to form a stable octet. It can therefore form a double bond with two oxygen atoms.	
	C: Students choosing this may have missed that a carbon atom is tetravalent and needs 4 electrons to form a stable octet. It can therefore form a double bond with two oxygen atoms.	
	D: Students choosing this may have missed that a carbon atom is tetravalent and needs 4 electrons to form a stable octet. It can therefore form a double bond with two oxygen atoms.	
14	**Correct Answer:** C The formula for both propanal and propanone is C_3H_6O. Hence, they both have the same number of hydrogen atoms.	1
	A: Students choosing this option may not be having a clear understanding of molecular formulae.	
	B: Students choosing this option may not be having a clear understanding of molecular formulae.	
	D: Students choosing this option may be thinking that different compounds cannot have the same formula.	
15	ring	1
16	(a) CH_3- CO - O - CH_2 - CH_3 ----$\overset{NaOH}{}$----> C_2H_5OH + CH_3COONa	1
	(b) CH_3COONa	1
17	(a) four electrons	1
	(b) C_nH_{2n}	1
	(c) CH_3 - CH = CH_2	1
	(d) CH_3 - CH_2 - CH_3	1
	(e) Such compounds burn with a yellow flame with lots of black smoke	1

Life Processes

Q.No.	Question	Marks
18	The image below shows the cross section of a blood vessel.  What will be the direction of blood flow? (A) only from P to Q (B) only from Q to P (C) both from P to Q and Q to P (D) (Cannot determine without understanding the organs between which this blood vessel is present.) ***[Skill: Understanding]***	1
19	In humans, which organ marks the beginning of enzymatic protein digestion? ***[Skill: Mechanical]***	1

20	Shown below is a representation of a dialysis unit with two tubes marked X and Y.  (a) Between X and Y, which tube is functionally similar to the renal vein? (b) Between filtration of blood, absorption of waste products, and selective reabsorption of essential nutrients, which process does NOT occur in a dialysis unit? (c) State one point of difference between blood and the dialysing fluid. ***[Skill: Understanding]***	0.5+0.5 +1

21	Joseph Priestley was an English chemist known for some of his experiments with plants. Shown below is the setup of one of his experiments. The jars were kept in sunlight for the same amount of time.  (a) In two points, describe the observation being made in setups X and Y, and explain the reason behind it. (b) Based on the setup, identify whether the following statements are true or false and justify your answers. (i) In the absence of sunlight, the plant will respire anaerobically. (ii) At night, air around the plant will be richer in carbon dioxide. ***[Skill: Application]***	3+1+1

Marking Scheme

Q No.	Rubric	Marks
18	**Correct Answer:** A Veins contain valves that prevent the back flow of blood or ensure that blood flows only in one direction. From the image and the orientation of the valve, it is clear that blood will flow only from P to Q and the back flow from Q to P will be prevented.	1
	B: Students choosing this may not be clear of the orientation of a valve.	
	C: Students choosing this may have missed the purpose of a valve in a vein.	
	D: Students may think that without knowing the organs between which blood is flowing one cannot determine the direction. They may have missed that the valve will help determine the direction of blood flow.	
19	stomach	1
20	(a) Tube X	0.5
	(b) selective reabsorption	0.5
	(c) Blood contains nitrogenous wastes like urea and creatinine, whereas the dialysing fluid is free of these wastes. *[Accept any other valid answers.]*	1
21	(a) • In setup X, the mouse is dying and candle flame is extinguishing. *[0.5 marks]* • The candle flame is burning and using up oxygen present in the closed jar causing the mouse to run out of oxygen to breathe and die. *[1 mark]* • In setup Y, the mouse remains alive and the candle flame also keeps burning. *[0.5 marks]* • While the burning candle flame is using oxygen, the plant is also providing oxygen/replenishing oxygen in the closed jar enabling the mouse to breathe and survive. *[1 mark]* *[Accept any other valid answer.]*	3
	(b.i) 0.5 marks for each of the following: • False • The plant will rely on oxygen already present in the air around it to respire. *[Accept any other valid answer.]*	1
	(b.ii) 0.5 marks for each of the following: • True • At night, the plant will only respire, giving out CO_2 but not utilising it for photosynthesis. *[Accept any other valid answer.]*	1

Control and Coordination

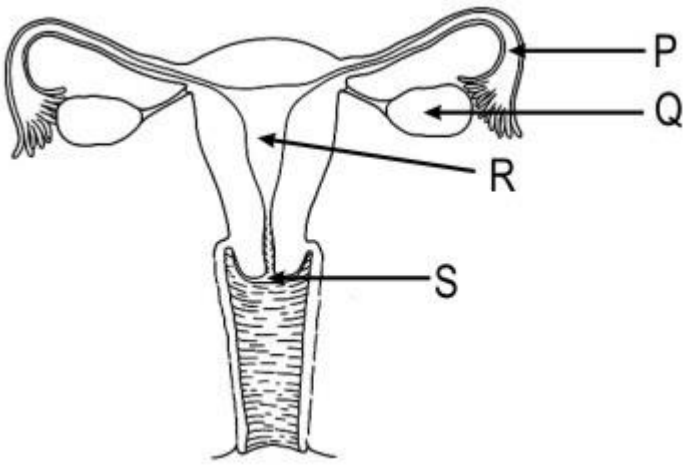
Q.No.	Question	Marks
22	The question below consists of two statements, Assertion (A) and Reason (R). Answer the questions by selecting the appropriate option given below. Assertion (A): Axons cannot receive an electrical impulse from other neurons. Reason (R): The synapse lies between the dendrites of two neurons. (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 and R is false. (D) A is false and R is true. ***[Skill: Understanding]***	1
23	Vivek was playing football with his friends. At one point, he saw a ball coming towards him and he quickly moved his head to dodge the ball. (a) Is this an example of a reflex action? Why or why not? (b) What is the path followed for this action to be completed? ***[Skill: Understanding]***	1+1
24	(a) Shown below is the pattern of root growth in a plant.  Based on the image, which types of tropic movement(s) can be seen in the roots of this plant? Justify your answer. (b) In a new plant, identify ONE hormone that is likely to be seen in young leaves. Justify. (c) In plants, hormones bind to specific receptors present in certain organs. On binding, they carry out their action. How is this mechanism beneficial to a plant? ***[Skill: Understanding]***	2+2+1

Marking Scheme

Q No.	Rubric	Marks
22	**Correct Answer:** C When information is received by receptors on sense organs, it is first transmitted to the dendrites. The dendrites then convert this chemical signal to an electrical impulse which travels through the neuron till the axon. At the end of the axon, the electrical impulse sets off the release of some chemicals. These chemicals cross the gap, or synapse, and start a similar electrical impulse in a dendrite of the next neuron. So, the synapse lies between the axon of one neuron and the dendrite of the next neuron.	1
	A: Students choosing this option may have missed that a synapse is between the axon terminal of one neuron and the dendrites of the next neuron.	
	B: Students choosing this option may have missed that a synapse is between the axon terminal of one neuron and the dendrites of the next neuron.	
	D: Students choosing this may be unclear about how a nerve impulse travels.	
23	(a) No this is not an example of a reflex action *[0.5 marks]* because Vivek saw the ball, judged whether it will hit him and then voluntarily moved his head to dodge it. *[0.5 marks]*	1
	(b) 1 mark for the correct path signal received by receptors in the eye ---> sensory neuron ----> brain ----> motor neuron ----> neck/head muscles	1
24	(a) 0.5 marks for each of the following points: • geotropism • movement of roots is towards gravity • hydrotropism • movement of roots is also influenced by presence of water	2
	(b) Auxin *[1 mark]* Since cells would rapidly elongate, auxin concentration will be high to promote this. *[1 mark]* OR Cytokinin *[1 mark]* Since rapid cell division would be required for the leaf to grow in size, cytokinin concentration is also likely to be high. *[1 mark]*	2
	(c) It ensures that the hormones act only on certain target organs and not anywhere else in the plants. *[Accept any other valid answer.]*	1

How do Organisms Reproduce?

Q.No.	Question	Marks
25	A couple is evaluating different contraceptive methods to prevent pregnancy. After researching various options, they decided to adopt a method that blocks sperm from reaching the released egg. Which of the following actions demonstrates their choice? P) The woman takes a daily contraceptive pill (oral pill). Q) The couple uses a condom during sexual intercourse. R) The woman undergoes surgery to tie her fallopian tubes. (A) only P (B) only Q (C) only Q and R (D) only P and R ***[Skill: Understanding]***	1
26	Stem cells, in animals, have the ability to divide and differentiate into any other cell type. Which method of asexual reproduction relies on cells like stem cells? ***[Skill: Mechanical]***	1
27	In an agricultural study, two sets of crops were grown using different propagation methods: • One set using tubers and propagating them vegetatively. • The other set using seeds. After several generations, it was observed that the crops propagated through tubers showed a decline in disease resistance, whereas the crops grown from seeds maintained stable disease resistance. Explain the reason behind this observation. ***[Skill: Understanding]***	3

28	(a) Hari was growing tomato plants in two fields - X and Y. The variety of tomato plants in field X were resistant to certain diseases while the variety of tomato plants in field Y were resistant to drought conditions. Hari knew that tomato plants had bisexual flowers. He removed the pistil from one variety and the stamen from the other variety. (i) How would the removal of stamen and pistil from each variety benefit Hari? Explain in two points. (ii) Hari's friend said that both varieties will continue to produce fruit. Justify if he is correct or not. (b) Shown below is a representative image of the human female reproductive system with some of its parts marked.  (i) 'Part R is the point where the egg and sperm fertilise.' Justify if this statement is true or false. (ii) Identify the label and name the part responsible for the production of the hormone estrogen. ***[Skill: Understanding]***	3+2

Marking Scheme

Q No.	Rubric	Marks
25	**Correct Answer:** C This option correctly identifies methods that act as barriers. Condoms act as a physical barrier that prevents sperm from entering the uterus, thus effectively preventing pregnancy. Blocking the fallopian tube will also prevent the egg from fertilising with the sperm.	1
	A: Students choosing this may have missed that it describes hormonal contraception, which works by altering the hormonal balance to prevent ovulation and does not act as a barrier to sperm. Therefore, it does not fit the definition of a barrier method.	
	B: Students choosing this may have missed that this correctly identifies a barrier method. Condoms act as a physical barrier that prevents sperm from entering the uterus, thus effectively preventing pregnancy but missed that tubectomy is also physically blocking the sperm	
	D: Students choosing this may have missed that it describes hormonal contraception, which works by altering the hormonal balance to prevent ovulation and does not act as a barrier to sperm. While it prevents pregnancy, it does not represent a barrier.	
26	Regeneration	1
27	• The crops propagated through tubers are genetically identical to the parent plant. *[0.5 marks]* • Over generations, this lack of genetic variation can lead to a decrease in disease resistance because the entire population is equally susceptible to the same pathogens. Without genetic diversity, the plants are unable to adapt to new or evolving diseases. *[1 mark]* • The crops grown from seeds undergo genetic recombination during fertilization, resulting in offspring with a mix of both parent plants. *[0.5 marks]* • This genetic variation increases the likelihood that some individuals in the population will have resistance to diseases, allowing the population as a whole to maintain stable disease resistance over generations. *[1 mark]*	3
28	(a.i) 1 mark for each of the following: • By removing the stamen from one variety and the pistil from the other, Hari prevents self-pollination within each variety. • The setup promotes cross-pollination between the disease-resistant plants and the drought-resistant plants which could produce offspring that inherit both traits leading to a new, more resilient variety of tomato plants.	2

	(a.ii) 0.5 marks for each of the following: • No, he is not correct. • Only the variety with the pistil will be able to bear fruits if it receives pollen, but the variety with just the stamen cannot bear fruits as it does not have the pistil.	1
	(b.i) This statement is false *[0.5 marks]* because fertilisation occurs in the oviduct and not the uterus. *[0.5 marks]*	1
	(b.ii) The part is part Q *[0.5 marks]* and is called the ovary *[0.5 marks]*	1

Heredity

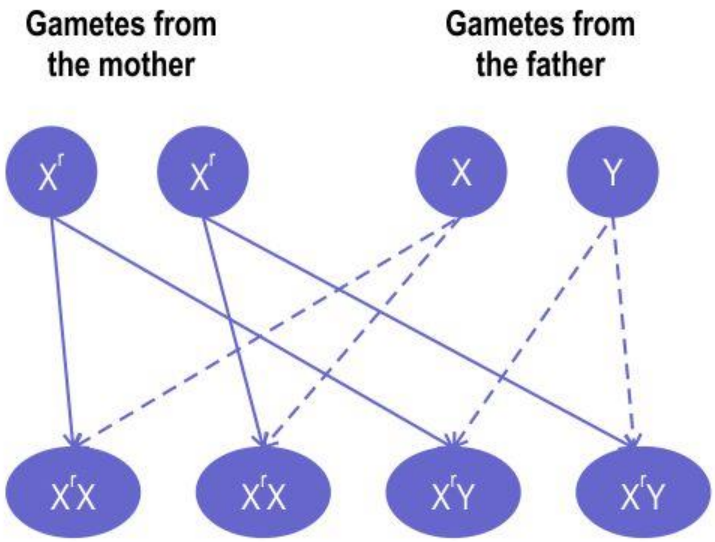
Q.No.	Question	Marks
29	Heterotrophic plants, such as the Venus flytrap, have special adaptations that help them consume insects to obtain nitrogen. This variety of plants is a variation from most other plants that get nitrogen from the soil (autotrophic plants). Consider a region where most plants are autotrophic while a small population of heterotrophic plants also exists. If the soil in this region would slowly become very poor in nitrogen, which of the following would happen and why? (A) Heterotrophic plants would provide nitrogen to the autotrophic plants so that both varieties can survive. (B) Heterotrophic plants would have a better chance at surviving as they don't depend on nitrogen from soil. (C) All plants would continue to survive as nitrogen is not an important nutrient for plants. (D) Autotrophic plants would modify themselves immediately to consume insects. ***[Skill: Application]***	1
30	Besides genetics, mention one other factor that can determine the sex of an organism of some species. ***[Skill: Mechanical]***	1

31	Red-green colour blindness is a disease caused due to a mutation on the X-chromosome. In females, • If two copies of such a defective X-chromosome are present then they show symptoms of the disease. • If one copy of the defective X-chromosome is present then they do not show the symptoms of the disease. In males, • A defective X-chromosome causes the disease symptoms to show up. If a woman who is showing red-green colour blindness marries a man who does not have a defected copy of the X-chromosome, then what percentage of: (a) female children will show the symptoms of the disease (b) male children will show the symptoms of the disease Draw the cross to explain your answer. ***[Skill: Application]***	1+1+1

32	Given below is a dihybrid cross between two varieties of pea plants - one having full, green pods and the other having constricted, green pods. The traits for full (F) and green (G) pods are dominant over the traits for constricted (f) yellow (g) pods. **Dihybrid cross** **P Generation** FFGg × ffGg **F_1 Generation** (a) What percentage of gametes from the P generation will have both the traits - constricted and yellow pods? Justify your answer. (b) What would be the phenotypic ratio in the F1 generation? (c) If the F1 generation had 80 plants, what would be the number of plants having: (i) full and yellow pods (ii) constricted and yellow pods ***[Skill: Application]***	2+1+2

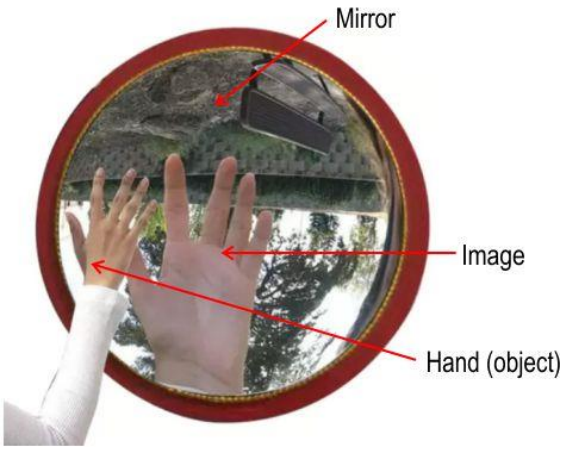
	FG	Fg	FG	Fg
fG	FfGG	FfGg	FfGG	FfGg
fg	FfGg	Ffgg	FfGg	Ffgg
fG	FfGG	FfGg	FfGG	FfGg
fg	FfGg	Ffgg	FfGg	Ffgg

Marking Scheme

Q No.	Rubric	Marks
29	**Correct Answer:** B Heterotrophic plants like the Venus flytrap have adapted to nitrogen-deficient environments by consuming insects and obtaining nitrogen from their prey. In contrast, autotrophic plants depend on nitrogen from the soil, so they would struggle in nitrogen-poor conditions.	1
	A: Students choosing this may have missed that heterotrophic plants do not share nutrients with autotrophic plants, as each plant operates independently to obtain resources for its own survival.	
	C: Students choosing this may have missed that nitrogen is essential for plants as it is a key component of amino acids, proteins, and chlorophyll. Without sufficient nitrogen, plants cannot grow or perform photosynthesis effectively.	
	D: Students choosing this may have missed that changes or adaptations such as developing insect-trapping adaptations occur over long periods and not immediately in response to environmental changes.	
30	temperature *[Accept any other valid answer.]*	1
31	1 mark for the cross:  *[Accept the cross in any other format.]* (a) None of the female children will show the symptoms of the disease. *[1 mark]* (b) All the male children will show the symptoms of the disease. *[1 mark]*	3
32	(a) 1 mark for each of the following: • Four types of gametes are being formed - FG, Fg, fG and fg • So, the gamete having both f and g traits would be 1/4 or 25%	2
	(b) Phenotypic ratio:	1

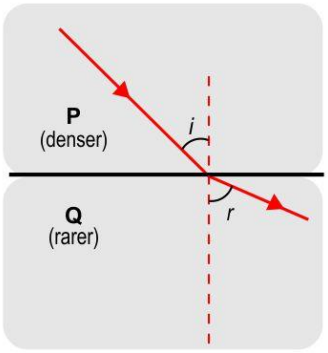
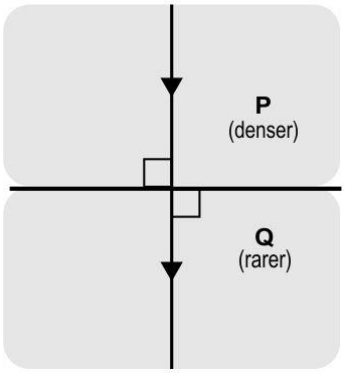
	Full and green pods: Full and yellow pods = 3:1	
	(c) 1 mark for each of the following: (i) 20 plants (ii) 0 plants	2

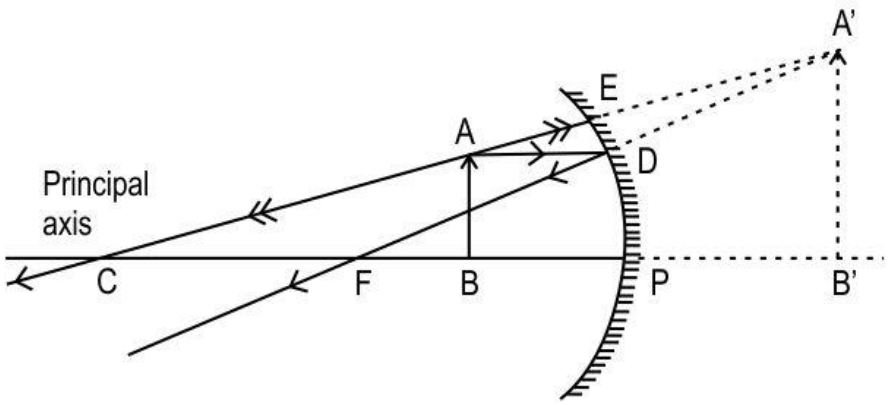
Light - Reflection and Refraction

Q.No.	Question	Marks
33	The question below consists of two statements, Assertion (A) and Reason (R). Answer the questions by selecting the appropriate option given below. Assertion (A): Parallel rays of light incident on a convex mirror diverge after reflection. Reason (R): A ray of light incident on a spherical mirror does not obey the laws of reflection. (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 and R is false. (D) A is false and R is true. ***[Skill: Understanding]***	1
34	The refractive indices of two media P and Q are 2.42 and 1.5 respectively. Illustrate the path of a ray of light travelling from medium P to Q, when the ray of light falls: (i) obliquely at the interface of media P and Q (ii) perpendicularly at the interface of media P and Q ***[Skill: Understanding]***	1+1
35	Observe the image shown below and answer the following questions:  (a) Identify the type of mirror shown. Explain. (b) Using a ray diagram, illustrate the position of the object (the hand) and the formation of its image. You may use an arrow to represent the hand. ***[Skill: Understanding]***	1+2

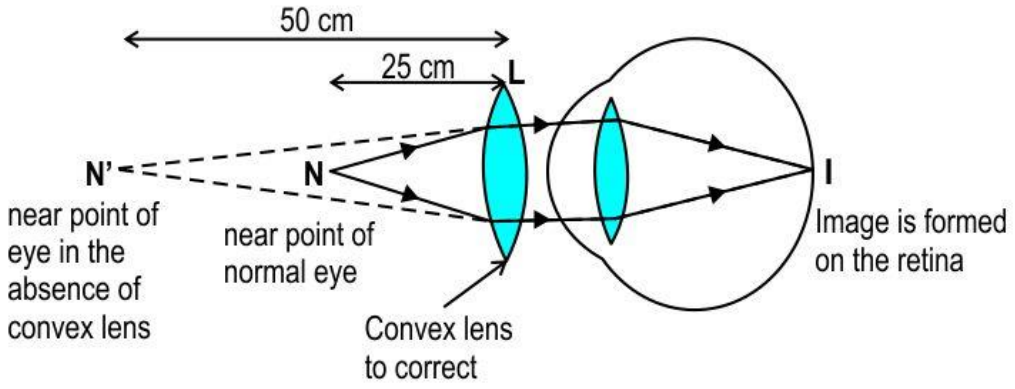
36	(a) An object is placed 15 cm from a thin lens. A five times magnified and focused image is formed on a screen. (i) What is the nature of the image formed? Explain. (ii) Determine the focal length of the lens used. (b) Two thin lenses when placed in contact have a total power of 10 D. If one of the lenses is diverging with a focal length of 20 cm, determine the focal length of the other lens placed in contact. ***[Skill: Understanding]***	3+2

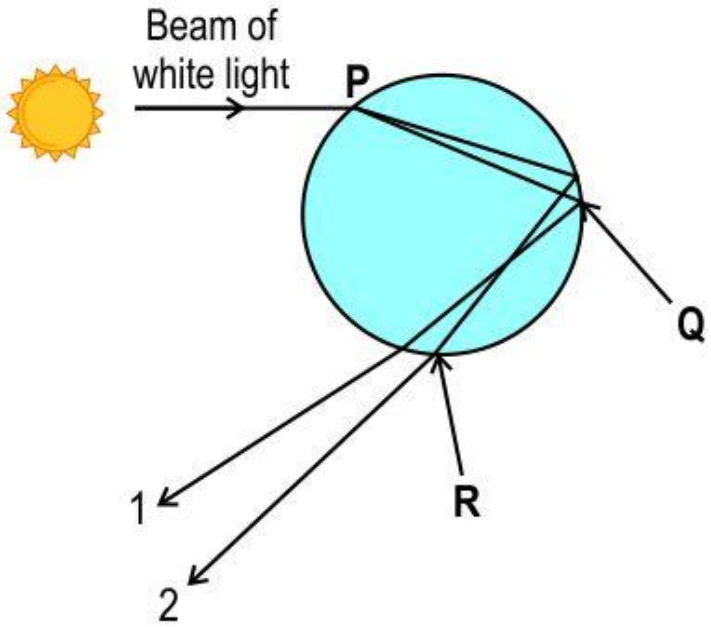
Marking Scheme

Q No.	Rubric	Marks
33	**Correct Answer:** C A convex mirror diverges the parallel rays of light. A ray of light incident on any mirror or spherical surface follows laws of reflection.	1
	A: Students choosing this may lack the understanding that laws of reflection are followed for all mirrors and surfaces.	
	B: Students choosing this may lack the understanding that laws of reflection are followed for all mirrors and surfaces.	
	D: Students choosing this may lack the understanding that laws of reflection are followed for all mirrors and surfaces and lack understanding about convex mirrors.	
34	(a)  *[1 mark for depicting the ray of light bending away from the normal as it travels from medium P to Q]* (b)  *[1 mark for depicting the ray of light travelling undeviated as it travels from medium P to Q.]*	2

35	(a) concave mirror/converging mirror. *[0.5 marks]* The image formed in the mirror is erect and magnified that indicates that the mirror is concave/converging. *[0.5 marks]* (b)  *[Award 1 mark for the correct depiction of any two convenient rays; 0.5 marks each for correct depiction of position of image and image; Deduct 0.5 marks for absence of arrow heads]*	3
36	(i) The image is real, inverted and magnified. *[0.5 marks]* *[Marks to be awarded only if real and inverted are mentioned]* It is given that the image is formed on a screen and only real images, that are also inverted can be formed on a screen. *[0.5 marks]* (ii) m = v/u *[0.5 marks]* -5 = v/-15 v = 75 cm *[0.5 marks]* 1/f = 1/v - 1/u *[0.5 marks]* 1/f = 1/75 + 1/15 1/f = 6/75 f = 75/6 = 12.5 cm *[0.5 marks]*	3
	(b) $P = P_1 + P_2$ *[0.5 marks]* P = 1/f (in m) *[0.5 marks]* P_1 = -100/20 = - 5 D 10 = - 5 + P_2 P_2 = 15 D $f_2 = 1/P_2$ = 6.67 cm *[1 mark]* *[Accept any other correct method of arriving at the correct answer.]*	2

Human Eye and the Colourful World

Q.No.	Question	Marks
37	On the Moon, the transition between lunar day and night is very abrupt. When the Sun rises, it does so suddenly without the gradual brightening that we experience on Earth. Similarly, when the Sun sets, it becomes dark almost immediately. Which of the following explains the abrupt transition between lunar day and night? (A) The moon has no atmosphere. (B) The moon reflects the sunlight. (C) The moon is much smaller than Earth. (D) One day on the Moon is 29.5 Earth days. ***[Skill: Understanding]***	1
38	A person with_____ needs a diverging lens for correction. ***[Skill: Mechanical]***	1
39	The image below illustrates how a convex lens is used to correct the eye defect of a person.  (a) Referring to the image above, calculate the power of lens required to correct the person's eye defect. (b) In the absence of the convex lens, where is the image likely to form in the scenario shown above? Explain based on the information inferred from the image. ***[Skill: Application]***	2+1

40	Rainbows are typically seen in the sky following a rain shower, as sunlight passes through water droplets suspended in the air. The figure below shows the path of a sunlight ray entering a water droplet in the air.  (a) Name all the phenomena of light that occurs at point P that results in the formation of a rainbow. (b) Identify and list any two differences in the phenomena of light that occur at points Q and R and result in the formation of a rainbow. (c) The light rays labelled as 1 and 2 represent either blue or red light. Which ray is likely to represent blue light? Explain. ***[Skill: Application]***	1+3+1

Marking Scheme

Q No.	Rubric	Marks
37	**Correct Answer:** A Due to an absence of an atmosphere on the moon, there are no particles to cause scattering or refraction of sunlight. Hence option A is correct.	1
	B: Students choosing this option may have missed that Earth also reflects sunlight.	
	C: Students choosing this option may be thinking that due to its much smaller size the moon has a very sharp demarcation between night and day.	
	D: Students choosing this option may be thinking that the longer day and night on the moon prevents a very sharp demarcation between night and day.	
38	myopia/near-sightedness/short-sightedness	1
39	(a) u = - 25 cm v = - 50 cm 1/f = 1/v - 1/u *[0.5 marks]* 1/f = -1/50+ 1/25 1/f = 1/50 *[0.5 marks]* P = 1/f (in m) *[0.5 marks]* P = 1/50 x 100 = 2 D *[0.5 marks]*	2
	(b) The image for the person suffering from this eye defect will be formed behind the retina if the convex lens is not used. *[0.5 marks]* This is because the converging power will decrease in the absence of the convex lens. *[0.5 marks]*	1
40	(a) At the surface P two phenomena occur: • refraction *[0.5 marks]* • dispersion *[0.5 marks]*	1
	(b) Phenomena occurring at surface Q is reflection and at surface R is refraction. *[Award 0.5 marks only if both the phenomena are mentioned correctly. No marks to be awarded if phenomena at surface Q is mentioned as Total Internal Reflection.]* 1 mark for each of the following points: • Reflection is the bouncing of light when it falls on a reflecting surface while refraction is the bending of an oblique ray of light when it travels from one optical medium to another. • In reflection the angle of incidence is always equal to angle of refraction while in refraction, angle of incidence and angle of refraction may or may not be equal. *[Accept any other valid point of difference.]*	3

	(c) Ray 1 represents blue light. *[0.5 marks]* On sunlight passing from air to water at P, red light bends less than blue light. Retracing light rays backwards it is seen that light ray 1 bends more than light 2 and hence is likely to represent blue light. *[0.5 marks]* *[Accept any other correct reason.]*	1

Electricity

<table>
<tr><th>Q.No.</th><th>Question</th><th>Marks</th></tr>
<tr><td>41</td><td>The question below consists of two statements, Assertion (A) and Reason (R).

Answer the questions by selecting the appropriate option given below.

Assertion (A): The resistance of copper wire increases with increase in temperature.
Reason (R): Copper wire obeys Ohm's law.

(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 and R is false.
(D) A is false and R is true.

[Skill: Understanding]</td><td>1</td></tr>
<tr><td>42</td><td>A water kettle takes 5 minutes to boil 500 mL of water at room temperature using a 220 V power supply. After repairing the kettle, an electrician replaces its heating element with one that has double the resistance of the original.

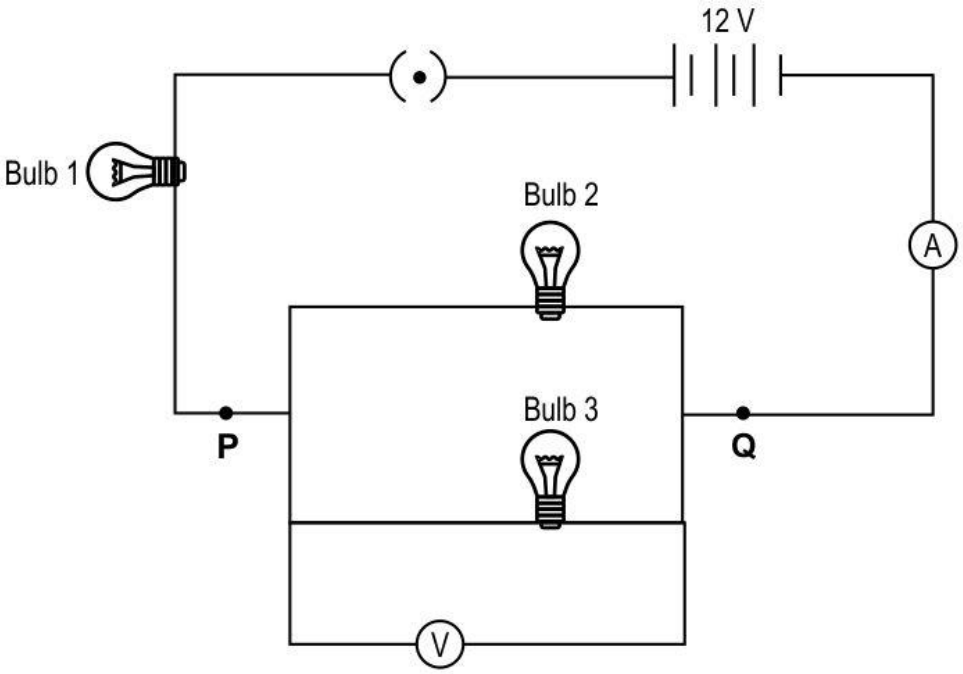
How much time will the kettle now take to boil the same amount of water under identical conditions?

[Skill: Application]</td><td>2</td></tr>
<tr><td>43</td><td>The resistivities of three materials P, Q, and R is shown below.

<table><tr><th>Materials</th><th>Resistivity (Ωm)</th></tr><tr><td>P</td><td>1.69×10^{-8}</td></tr><tr><td>Q</td><td>2.10×10^{16}</td></tr><tr><td>R</td><td>4.00×10^{-7}</td></tr></table>
(a) Considering the resistivity of the three materials, only one of the materials is suitable to make the outer coverings of wire. Which of the materials is it likely to be? Give reason.

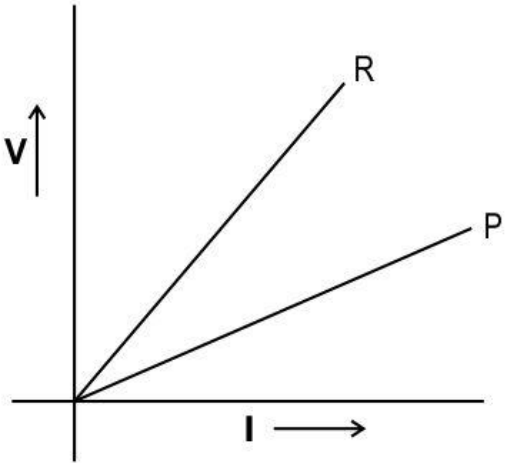
(b) Represent the resistance of wires made from materials P and R (having the same dimensions) qualitatively using a V-I graph.

[Skill: Understanding]</td><td>1.5+1.5</td></tr>
</table>

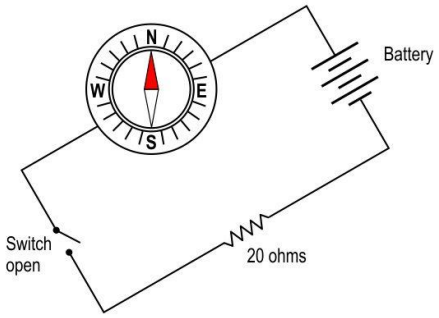
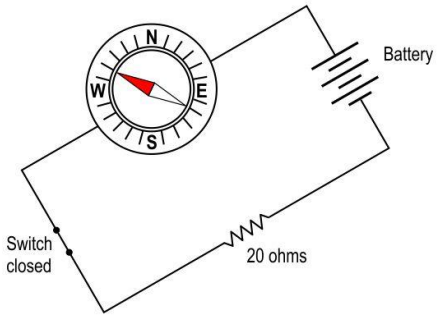
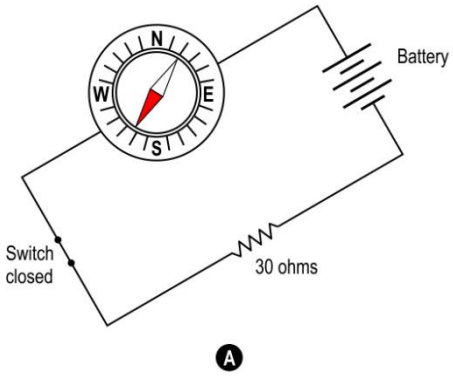
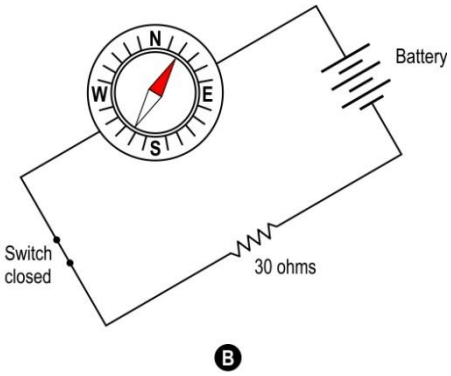
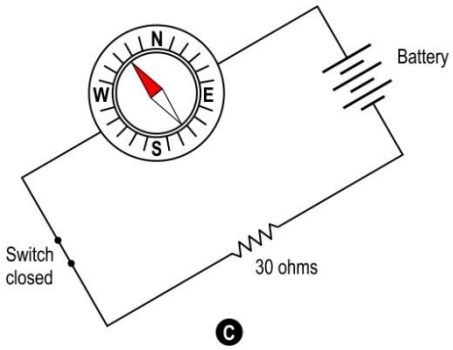
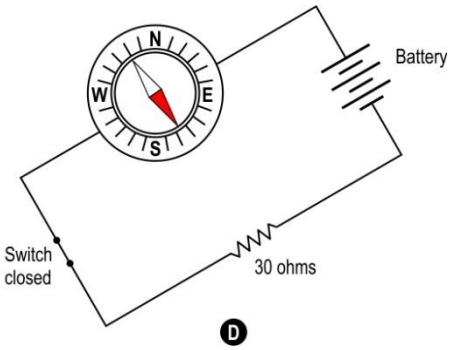
44	Three identical bulbs, each of resistance 2 Ω, are connected in an electric circuit, as shown below. When the switch is closed, the ammeter reads 2.5 A.  (a) Calculate the reading of the voltmeter V. (b) If one of the bulbs in the circuit fuses while the other two bulbs continue to glow, which bulb/s is/are most likely to fuse? Explain. (c) If points P and Q are connected through a conducting wire, do all the bulbs glow? Give reason. (d) What is the heat dissipated across Bulb 3 in 30 s? ***[Skill: Understanding]***	5

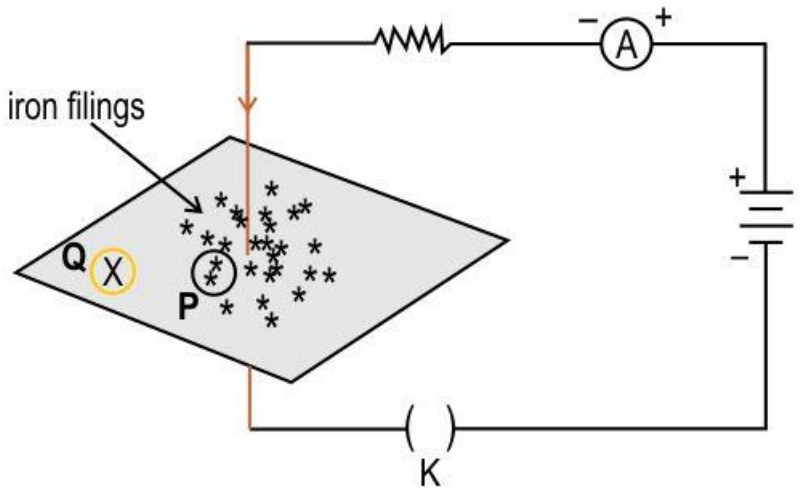
Marking Scheme

Q No.	Rubric	Marks
41	**Correct Answer:** B The resistance of a copper wire increases with an increase in temperature because the thermal agitation of atoms causes more frequent collisions of electrons, thereby increasing resistance. This makes the assertion true. The reason is correct as Ohm's law states that the current through a conductor is directly proportional to the voltage across it, provided the temperature and physical conditions remain constant. However, it does not directly explain the temperature-dependent increase in resistance. Hence, the reason is not the correct explanation for assertion.	1
	A: Students choosing this may lack the correct understanding of Ohm's law.	
	C: Students choosing this may lack the correct understanding of Ohm's law.	
	D: Students choosing this may lack the correct understanding of relation between resistance of metals and temperature.	
42	$R' = 2R$ Energy = power x time *[0.5 marks]* Power = V^2/R *[0.5 marks]* Energy required to boil 500 mL of water using heating element of resistance R: $P \times t = V^2/R \times t = V^2/R \times 300$ J Energy required to boil 500 mL of water using the heating element of resistance $R = P' \times t' = (V')^2/2R \times t$ When the heating element is replaced by a heating element of resistance 2R, the energy required to heat the same quantity of water through same temperature remains the same. Hence, $V^2/R \times 300 = (V')^2/2R \times t$ *[0.5 marks]* t = 600 s = 10 minutes *[0.5 marks]* *(Accept any other correct method of arriving at the correct answer.]*	2
43	(a) Of the three materials, material Q can be considered to make the outer coverings of wire. *[0.5 marks]* The primary purpose of the outer covering is to insulate the conducting wire. *[0.5 marks]* Of the given materials, material Q has the highest resistivity. The more the resistivity the lesser the current that flows through it, and better the insulator. *[0.5 marks]* *[Accept any other valid reason.]* (b)	3

	 *[Award 1 mark if the slopes of P and R are correctly represented; 0.5 marks for correctly labelled axes.]*	
44	(a) Voltage across Bulb 1 = IR *[0.5 marks]* = 2.5 x 2 = 5 V Hence, reading of V = 12 -5 = 7 V *[0.5 marks]* (b) Either Bulb 2 or Bulb 3 *[0.5 marks only if both the bulbs are mentioned.]* This is because both bulbs 2 and 3 are connected in parallel. *[0.5 marks]* Even if one of them fuses, the other bulb continues to work and the circuit remains completed. OR If bulb 1 fuses, then the circuit gets broken and none of the bulbs will glow. *[0.5 marks]* (c) No, all the bulbs will not glow. *[0.5 marks]* When points P and Q are connected through a conducting wire, it acts as a low resistance path and the current flows through this path and not through bulbs 2 and 3. Hence, only bulb 1 will continue glow. *[1 mark for correct answer and reason. Accept any other valid reason]* (d) $H = I^2Rt = V^2t/R$ *[0.5 marks]* = (7 x 7 x 30)/2 = 735 J *[0.5 marks]*	5

Magnetic Effects of Current

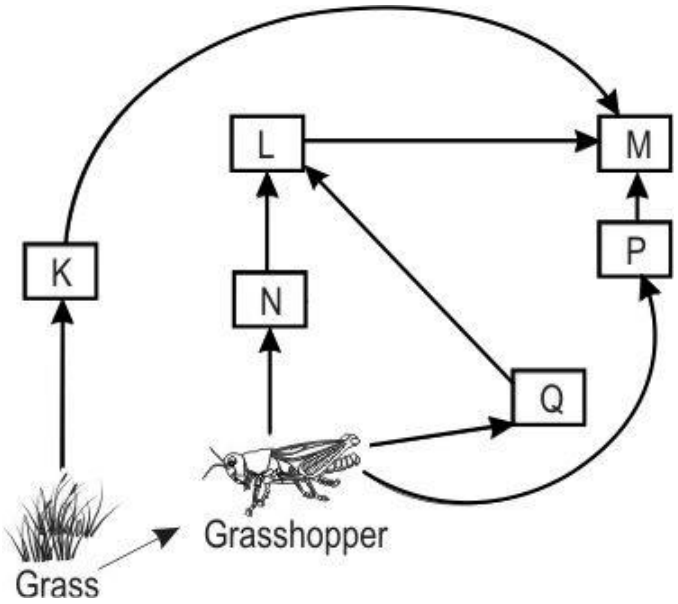
Q.No.	Question	Marks
45	A compass is placed below the wire of a circuit composed of a switch, a battery, and a 20 ohm resistor. Figure 1 shows the position of the compass needle when the circuit is open. Figure 2 shows that the compass needle is deflected towards the west when the circuit is closed.  Fig.1  Fig.2 The 20 ohm resistor is replaced by a 30 ohm resistor. Which of the following now shows the likely deflection of the compass needle?  A  B  C  D ***[Skill: Application]***	1
46	Both fuse and earth wire are safety measures used in electric circuits. How do the safety measures differ in their function? ***[Skill: Mechanical]***	2

47	The image below shows an experimental setup of an open circuit consisting of a conducting wire that is passed through a rectangular piece of cardboard on which some iron filings are sprinkled.  The switch is then closed and a current is allowed to flow through the wire. (a) What happens to: (i) iron fillings when the current is passed through the wire. (ii) copper turnings if they are used instead of iron filings in (a.i)? Explain. (b) Why and how will the answer to part (a.i) change: (i) when the direction of current is reversed? (ii) when the wire is connected to a battery of higher voltage? ***[Skill: Understanding]***	3+2

Marking Scheme

Q No.	Rubric	Marks
45	**Correct Answer:** C Increasing the resistance will decrease the current in the circuit, but will not change the direction of current. Therefore, only the extent of deflection will be reduced.	1
	A: Students choosing this may think that the extent of deflection will increase with an increase in resistance. They may not understand the relationship between current and resistance.	
	B: Students choosing this may be guessing.	
	D: Students choosing this may think that the extent of deflection as well as the direction of current will change.	
46	A fuse prevents the appliance from damage during short-circuiting or overloading. *[1mark]* Earth wire on the other hand prevents us from electric shocks when there is an accidental leakage of current. *[1 mark]*	2
47	(a-i) When the current is passed through the wire, the iron fillings arrange themselves in the form of concentric circles. *[1 mark]* (a-ii) 1 mark for each of the following: - The copper turnings will not rearrange themselves when current is passed. - This is because copper is non-magnetic and does not respond to a magnetic field, so it will not align in concentric circles like iron filings.	3
	(b) (i) When the direction of current is reversed, the iron fillings will continue to be arranged in concentric circles without any change. *[0.5marks]* This is because the strength of magnetic field around the current carrying conductor does not change as magnitude of current does not change. *[0.5 marks]* (ii) The iron fillings will be more densely arranged in concentric circles. *[0.5marks]* The magnitude of current through the wire increases and hence the strength of magnetic field around the current carrying conductor increases. *[0.5 marks]*	2

Our Environment

Q.No.	Question	Marks
48	Shown below is a food chain that is a part of a food web. **Plant ------> Organism X ------> Organism Y ------> Organism Z** Which of these organisms can be an omnivore? (A) only X (B) only Y (C) both Y and Z (D) all - X, Y and Z ***[Skill: Understanding]***	1
49	In food webs, we usually have producers, primary consumers, secondary consumers, and tertiary consumers. Sometimes an organism may fall into two categories. For example, an omnivore will be both a primary as well as a secondary consumer. In the food web shown below, which letter represents an organism that is ONLY a tertiary consumer, and is not any other type of consumer?  ***[Skill: Application]***	1
50	Which organism is likely to have greater chemical accumulation in its body, a carnivore or a herbivore? Justify your answer. ***[Skill: Understanding]***	2

Marking Scheme

Q No.	Rubric	Marks
48	**Correct Answer:** D An omnivore is an organism that consumes both plants and other animals and hence is a consumer. In any food chain the first organism has to be a producer. Any of the consumers in the food chain can be an omnivore, consuming plants and other animals. Hence organisms X, Y and Z can be omnivores.	1
	A: Students choosing this option may be unclear about the food habits of an omnivore and the composition of food chains.	
	B: Students choosing this option may be unclear about the food habits of an omnivore and the composition of food chains.	
	C: Students choosing this option may be unclear about the food habits of an omnivore and the composition of food chains.	
49	the letter L	1
50	A carnivore *[0.5 marks]* As the trophic level increases, the chemical accumulation in the body also increases. *[1 mark]* A carnivore is at a higher trophic level than a herbivore. *[0.5 marks]*	2

Board of School Education Haryana, Bhiwani