Competency Focused Practice Questions

Science | Grade 10

Co-created by
Centre for Excellence in Assessment
CBSE
and
Educational Initiatives

Preface

Assessments are an important tool that help gauge learning. They provide valuable feedback about the effectiveness of instructional methods; about what students have actually understood and also provide actionable insights. The National Education Policy 2020 has outlined the importance of competency-based assessments in classrooms as a means to reform curriculum and pedagogical methodologies. The policy emphasizes on the development of higher order skills such as analysis, critical thinking and problem solving through classroom instructions and aligned assessments.

Central Board of Secondary Education (CBSE) has been working closely with Educational Initiatives (Ei) in the area of assessment and capacity of the board. Through resources like the Essential Concepts document and A-Question-A-Day (AQAD), high quality assessment questions and concepts critical to learning have been shared with schools and teachers.

Continuing with the vision to ensure that every student is learning with understanding, Question Booklets have been created for five subjects of Grade 10. These booklets contain competency-based items, designed specifically to test conceptual understanding and application of concepts.

Process of creating competency-based items

All items in these booklets are aligned to the NCERT curriculum and have been created keeping in mind the learning outcomes that are important for students to understand and master. Items are a mix of subjective questions and Multiple-Choice Questions (MCQs). In case of MCQs, the options (correct answer and distractors) are specifically created to test for understanding and capturing specific errors/misconceptions that students may harbour. Each incorrect option can thereby inform teachers on specific gaps that may exist in student learning. In case of subjective questions, each question also has a a detailed scoring rubric to guide evaluation of students' responses.

Each item has been reviewed twice by the experts, to check for appropriateness of the item, validity of the item, conceptual correctness, language accuracy and other nuances. The process is designed to increase the quality of each question.

How can these item booklets be used?

The purpose of these item booklets is to provide samples of high-quality competency-based items to teachers. The items can be used to–

- get an understanding of what good competency-based questions could look like
- give exposure to students to competency-based items
- assist in classroom teaching and learning
- to get inspiration to create more such competency-based items

Students can also use this document to understand different kinds of ques ons and prac ce specific concepts and competencies.

Please write back to us if there is any feedback.

Team CBSE

Table of Contents

Chapter - 1
Chemical Reactions and Equations

Q: 1 **Which of the following is an example of simple displacement?**

1. the electrolysis of water
2. the burning of methane
3. the reaction of a metal with an acid
4. the reaction of two salt solutions to form a precipitate

Q: 2 **Which of the following is a NECESSARY condition for ALL chemical reactions?**

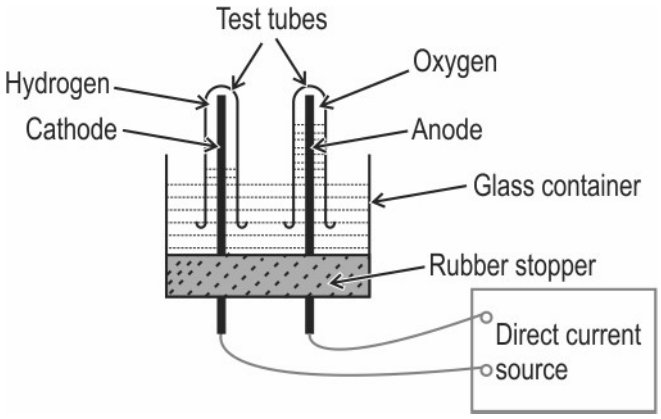
1. The reactants should be in the same state.
2. Energy should be supplied to the reactants.
3. The reactants should be at the same temperature.
4. There should be physical contact between the reactants.

Q: 3 **Given below is the balanced chemical equation for the thermal decomposition of lead nitrate.**

Which of the following information does the coefficients of PbO and NO_2 in the equation (2 and 4 respectively) tell us?

1. the ratio of the number of moles produced of the two substances
2. the ratio of the number of atoms in the two substances
3. the ratio of the mass produced of the two substances
4. the ratio of the densities of the two substances

Q: 4 **The diagram below shows the set-up in which electrolysis of water takes place.** **[3]**



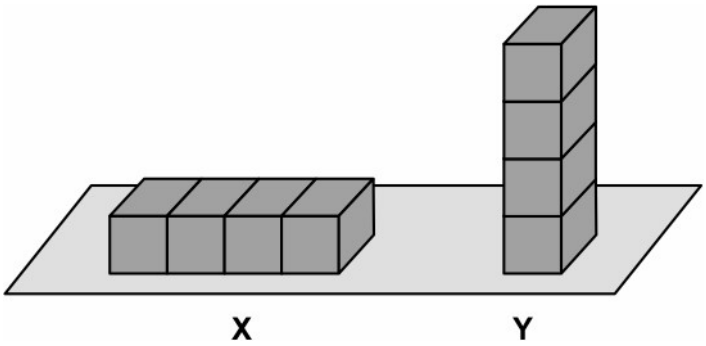
(a) What type of reaction takes place?

(b) Explain why this is an example of an endothermic reaction?

(c) The test tube containing hydrogen is removed carefully from the apparatus. A lit match stick is brought near the mouth of this test tube. The gas burns with an explosive "pop" sound.

Write a balanced chemical equation for this reaction and indicate whether energy is absorbed or released.

Q: 5 **Eight identical, iron blocks are placed on the ground in the two arrangements X and Y as shown below. The block arrangements are kept moist by sprinkling water every few hours** **[2]**



Which of the arrangements is likely to gather more rust after ten days? Justify your answer.

Q: 6 The following chemical equation does not represent a chemical reaction that can take place. [1]

$3\ Fe\ (s) + 4\ H_2O\ (l) \text{-----> } Fe_3O_4\ (s)$

State what needs to be changed in the equation above for it to represent the correct reaction between Fe and H_2O.

Q: 7 Trupti mixes an aqueous solution of sodium sulphate (Na_2SO_4) and an aqueous solution of copper chloride ($CuCl_2$). [2]

Will this lead to a double displacement reaction? Justify your answer.

Q: 8 Dilip was comparing combination reactions with decomposition reactions. [1]

Which class of chemical substances may be the product of a decomposition reaction but NOT a product of a combination reaction?

Q: 9 Write the balanced chemical equation of any one reaction that CANNOT be classified as combination, decomposition, simple displacement or double displacement. [1]

Q: 10 Tina finds a paper covered with a white substance in a chemistry lab. She keeps the paper near the window of the lab and comes back to pick it up after five hours to take it home. She noticed that the white substance had turned grey. [3]

(a) What could be the most likely substance on the paper that Tina found?
(b) The substance changed from white to grey. Write the chemical equation for this reaction.
(c) State ONE application of this property of the substance seen in daily life.

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	3
2	4
3	1

Q.No	Teacher should award marks if students have done the following:	Marks
4	(a) Decomposition / Electrolytic decomposition	0.5
	(b) Energy in the form of electrical energy is absorbed during the decomposition of water.	1
	(c) Balanced equation: $2H_2O$ + energy ---> $2H_2 + O_2$ *- 0.5 marks for correctly mentioning the reactants and products* *- 0.5 marks for balancing the reaction* - 0.5 marks for showing the endothermic nature of the reaction	1.5
5	- arrangement Y [1 mark] - Rusting is a surface phenomenon. [0.5 marks] - Arrangement Y has a larger surface area exposed to air. [0.5 marks]	2
6	The water should be in the form of steam, not liquid.	1
7	There will be no reaction.	1
	1 mark for either of the following: - All the ions will be in solution. - There is no insoluble product formed on mixing the two solutions.	1
8	element	1
9	1 mark for any correct example such as: $CH_4 + 2\ O_2$ ---> CO2 + 2 H_2O 6 CO_2 + 6 H_2O ---> $C_6H_{12}O_6 + 6\ O_2$	1
10	(a) silver chloride (AgCl) / silver bromide (AgBr)	1

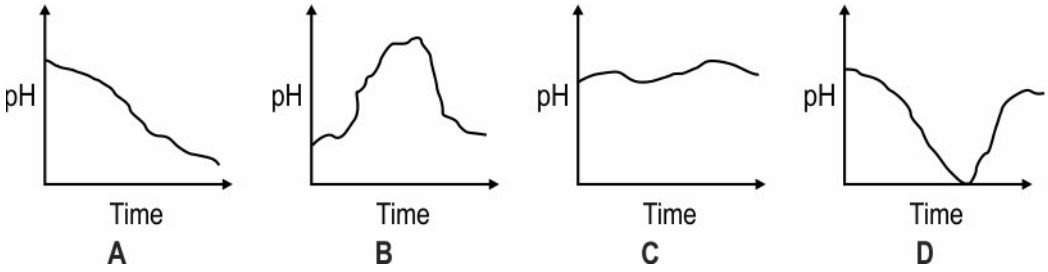
Q.No	Teacher should award marks if students have done the following:	Marks
	(b) $2AgCl \rightarrow 2Ag + Cl_2$ OR $2AgBr \rightarrow 2Ag + Br_2$	1
	(c) in black and white photography (Accept any other valid answer.)	1

Chapter - 2
Acids, Bases and Salts

Q: 1 **Adding which of the following to a colourless solution would give an indication that the solution could possibly be hydrochloric acid?**

1 copper metal strips
2 silver metal strips
3 calcium carbonate
4 sodium chloride

Q: 2 **Which of these graphs shows how the pH of milk changes as it forms curd?**



Q: 3 **The following table lists the pH values of some substances.** **[1]**

Solutions	pH
hydrochloric acid	1
milk	6
pure water	7
baking soda	9
sodium hydroxide	14

What would happen to the pH of an acid and a base when each is diluted (pure distilled water is added to it)?

Q: 4 **The pH of three solutions is given in the table. Answer the questions that follow.** **[3]**

Solution	**pH**
P	1
Q	7
R	14

(a) Which of these solutions could possibly react with zinc metal to produce hydrogen gas?
(b) Which of these solutions could be formed by the reaction of a metal oxide with water?
(c) Which of these solutions could be the raw material for the industrial manufacture of chlorine?

Q: 5 **A remarkable property of acids is that they can 'dissolve' metals. When metals are added to an acid, they disintegrate and disappear into the acid.** **[5]**

(a) State one other common observation when metals 'dissolve' in acids. Explain the reason for this observation.

(b) If the acid with the 'dissolved' metal is evaporated, can we get the metal back? Why or why not?

(c) In this question, the word 'dissolve' is used within quotes. This is because it is not actually an example of dissolving. What is the MAIN difference between a metal 'dissolving' in an acid and sugar dissolving in water?

Q: 6 **Sunita carried out the following reactions in the laboratory:** **[3]**
(i) complete neutralisation of one mole of sodium carbonate with hydrochloric acid
(ii) complete neutralisation of one mole of sodium bicarbonate with hydrochloric acid

She found that the amount of carbon dioxide formed in both the reactions was the same.

(a) Is her finding correct? Justify your answer.
(b) How does the amount of salt formed in case (i) compare with the amount of salt formed in case (ii)?

Q: 7 **To prepare a salad dressing, Parag adds a solution of sodium chloride in distilled water to vinegar.** **[2]**

State what change will occur in the following:
(i) the pH of the vinegar
(ii) the acidity of the vinegar

Rajesh was given a substance and asked to identify it. He conducted three tests on the substance and recorded the results below.(P) It releases carbon dioxide, water and a sodium salt on heating with water.(Q) It turns universal indicator greenish-blue.(R) It can be prepared from ammonia as a raw material.

Q: 8 **What substance was Rajesh given?** **[1]**

Q: 9 **Give ONE use of the substance based on the properties mentioned in P and Q.** **[1]**

Q: 10 **Rajesh later read that recrystallisation of the sodium salt formed in P gives another basic salt that is used in manufacture of borax.** **[1]**

Identify the sodium salt formed in P.

Q: 11 **Aditi finds that a mixture of an acid and a base does not change the colour of either red or blue litmus paper.** **[1]**

Compare the amounts of H^+ and OH^- in the solution.

Q: 12 **pH is measured on a scale of 0 to 14, with lower values indicating high hydrogen ion concentration (more acidic) and higher values indicating low hydrogen ion concentration (less acidic). A pH of 7 is considered as neutral. Every whole unit in pH represents a ten-fold increase in or decrease in hydrogen ion concentration.** **[1]**

What would the hydrogen ion concentration of a solution of pH 4 be compared to a solution of pH 8?

Q: 13 **pH is measured using a pH meter, which comprises a detecting unit consisting of a pH sensitive glass electrode and an indicating unit which indicates the pH as shown below.** **[2]**

pH meter

To measure the pH of a solution, the glass electrode is dipped into the solution and the pH is displayed on the screen of the indicating unit. Before measuring the pH of another solution, the glass electrode is rinsed with distilled water and dried carefully with tissue paper.

How is the pH reading of the second solution likely to be affected if the glass electrode is not dried with tissue paper in the following cases?
(i) if the second solution being measured is acidic in nature
(ii) if the second solution being measured is basic in nature

Q: 14 **Dipti has three flasks containing dilute hydrochloric acid, dilute sulphuric acid and dilute sodium hydroxide respectively. The flasks are not labeled and she does not have any pH indicator.** **[2]**

(a) Which of the solutions will she be able to identify just by making mixtures of pairs of the substances.
(b) What observation will help her to make this identification?

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	3
2	1

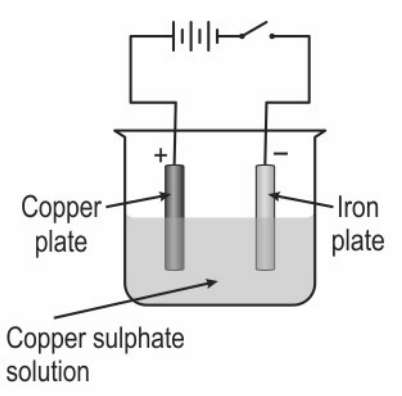
Q.No	Teacher should award marks if students have done the following:	Marks
3	- The pH of an acid would increase. [0.5 marks] - The pH of a base would decrease. [0.5 marks]	1
4	(a) 0.5 marks each for the following: - solution P - solution R	1
	(b) solution R	1
	(c) solution Q	1
5	(a) 1 mark each for observation and reason: Observation: Bubbling is seen. Reason: Because hydrogen is produced. OR Observation: The vessel becomes warm. Reason: Because it is an exothermic reaction.	2
	(b) 1 mark each for stating yes/no and for reason: - No - The metal is present as a part of a salt solution.	2
	(c) Metal dissolving in acid is a chemical change while sugar dissolving in water is a physical change.	1
6	(a) - Yes, her finding is correct. [1 mark] - 1 mole of CO_2 is produced in both the cases. [1 mark] (Writing the balanced equations for both the cases should also be accepted as a justification.)	2
	(b) The amount of salt formed in case (i) is twice the amount of salt formed in case (ii).	1

Q.No	Teacher should award marks if students have done the following:	Marks
7	(i) The pH will increase.	1
	(ii) The acidity will decrease.	1
8	baking soda / sodium hydrogencarbonate / $NaHCO_3$	1
9	1 mark for any of the following: - used in antacids - used in toothpaste - used as a first aid in acidic insect bites	1
10	sodium carbonate / Na_2CO_3	1
11	The amount of H^+ is equal to the amount of OH^- in the solution.	1
12	A solution of pH 4 would have 10,000 times higher concentration of hydrogen ions compared to a solution of pH 8.	1
13	(i) The pH meter will indicate a slightly higher pH reading than the actual pH of the solution if the second solution is acidic.	1
	(ii) The pH meter will indicate a slightly lower pH reading than the actual pH of the solution if the second solution is basic.	1
14	(a) the dilute sodium hydroxide	1
	(b) The flasks containing mixtures of sodium hydroxide with hydrochloric acid and with sulphuric acid will be warm to touch.	1

Chapter - 3
Metals and Non-metals

Answer any four of the following five questions based on the information given below.

Krunal connected a copper plate and an iron plate to the positive and negative terminals of a battery respectively along with a switch. He immersed the plates into a beaker containing acidified copper sulphate solution.



Q: 1 **After a few minutes, even before he turned the switch on, he noticed that copper was deposited on the iron plate.**

This could have been due to _____.

1. electrolysis
2. electroplating
3. a combination reaction
4. a displacement reaction

Q: 2 **Which of the following is likely to happen when the current is started?**

1. Iron will be deposited on the copper plate.
2. Copper will continue to be deposited on the iron plate.
3. No reaction will occur at the iron plate or at the copper plate.
4. The copper already deposited on the iron plate will go back into the solution.

Q: 3 **Krunal now replaces the iron plate with a silver plate. He sees that there is no deposition of copper on the silver plate before starting the current.**

Which of the following could be the reason?

1. Silver is more reactive than iron.
2. Silver is less reactive than copper.
3. Silver is a poorer conductor of electricity than iron.
4. Silver is a better conductor of electricity than copper.

Q: 4 **What is likely to happen to the concentration of copper sulphate in the solution on passing electric current through the solution in the set-up with the silver plate?**

1. It will increase.
2. It will decrease.
3. It will remain the same.
4. (Cannot say without knowing the amount of current passed.)

Q: 5 **Which of the following will happen to the weights of the silver and copper plates after passing the current for some time?**

1. The weight of the silver plate will increase and that of the copper plate will decrease.
2. The weight of the copper plate will increase and that of the silver plate will decrease.
3. Both the plates will decrease in weight.
4. Both the plates will increase in weight.

Q: 6 **Three pieces of a rust free iron rod are completely coated with the following:** **[5]**

(i) plastic
(ii) oil paint
(iii) zinc

An identical scratch is made on each piece, thus exposing the iron. The pieces of iron are kept exposed to moist air for 10 days and then checked for rust formation.

(a) State if rusting will be observed at the point of the scratch on the three iron pieces.

(b) Give reasons for your answer in each case.

(c) Name the process of applying a protective zinc coating to steel or iron.

Q: 7 **Listed here is the reactivity of certain metals.** **[1]**

Metal	Reaction with air	Reaction with water	Reaction with dilute acids
Gold	Does not oxidise or burn	No reaction	No reaction
Sodium	Burns vigorously to form an oxide	Violent reaction	Violent reaction
Zinc	Burns to form an oxide	Reacts on heating	Reacts to produce hydrogen
Platinum	No reaction	Does not dissolve or react	No reaction

From the list above, identify the metal(s) that are likely to be found in a pure state in the Earth's crust.

Q: 8 **The blue-coloured solution of the sulphate salt of metal W is taken in a beaker. Metal powders X, Y and Z are added one after the other to the beaker. The colour changes occurring in the solution are shown below.** **[2]**

$$\underset{\text{Blue solution}}{W\text{-}SO_4} \xrightarrow{\text{Metal X}} \underset{\text{solution}}{\text{Colourless}} \xrightarrow{\text{Metal Y}} \underset{\text{solution}}{\text{Pink}} \xrightarrow{\text{Metal Z}} \underset{\text{solution}}{\text{Green}}$$

State what colour change, if any, will occur if metal X is again added to the green solution in the beaker. Explain why.

Q: 9 **A piece of iron rusts when it comes in contact with air and moisture. Prakash had two identical shiny iron pieces P and Q. To prevent the pieces from rusting, he coated piece P with oil paint and he galvanized piece Q with a coat of zinc metal. He noticed that the coatings were not complete and that a small part of the iron was exposed in both the pieces.** **[4]**

What is Prakash likely to observe about the exposed parts of the two iron pieces after some days? Explain why.

Q: 10 **Read the following statements.** **[2]**

(P) Stainless steel does not rust.
(Q) Iron, nickel and chromium form an alloy.

Does statement (Q) present a valid explanation for statement (P)? Justify your answer.

Q: 11 **A teacher asks her students to identify a metal, M. She gives them the following clues to help them.** **[3]**

(P) Its oxide reacts with both HCl and NaOH.
(Q) It does not react with hot or cold water but reacts with steam.
(R) It can be extracted by electrolysis of its ore.

(a) Identify the metal.
(b) Write the chemical equations for the reaction of the metal with HCl and NaOH respectively.
(c) What would happen if the metal is reacted with iron oxide?

Q: 12 **A metal oxide on being heated with carbon does NOT produce carbon dioxide.** **[1]**

Give a possible explanation for this behaviour of the metal oxide.

Q: 13 **A metallic element, M, has the following properties:** **[2]**

- floats on water
- can be cut with a knife
- occurs naturally as its chloride, of formula MCl
- its oxide dissolves in water to form the hydroxide

(a) State the method of manufacture of the metal M.
(b) Name the major byproduct obtained in the process.

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	4
2	2
3	2
4	3
5	1

Q.No	Teacher should award marks if students have done the following:	Marks
6	(a) (i) Rust will be seen on the plastic coated iron piece. [0.5 marks] (ii) Rust will be seen on the painted iron piece. [0.5 marks] (iii) No rust will be seen on the zinc coated iron piece. [1 mark]	2
	(b) (i) The iron rod is in contact with air and moisture. [0.5 marks] (ii) The iron rod is in contact with air and moisture. [0.5 marks] (iii) Zinc is more reactive than iron and gets oxidised in preference to the iron object. [1 mark]	2
	(c) galvanisation	1
7	0.5 marks each for identifying the following: - gold - platinum	1
8	No colour change will occur.	1
	Metal X is less reactive than metal Z. OR Metal X is lower than metal Z in the activity series.	1
9	1 mark each for the following: - The exposed part of piece P is rusted. - The exposed part of piece Q not rusted.	2
	1 mark each for the following: - Oil painting prevents rusting only by preventing contact of iron with moist air. [1 mark] - Galvanising also protects by zinc getting oxidised in preference to iron as it is more reactive than iron. [1 mark]	2

Q.No	Teacher should award marks if students have done the following:	Marks
10	Yes, it does. [1 mark] Since alloying can change the properties of a metal. [1 mark]	2
11	(a) Aluminium	0.5
	(b) 1 mark each for correct equations: $Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$ $Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$	2
	(c) It would displace iron to form aluminium oxide.	0.5
12	The metal is more reactive than carbon.	1
13	(a) electrolysis of the molten chloride	1
	(b) chlorine	1

Chapter - 4
Carbon and
Its Compounds

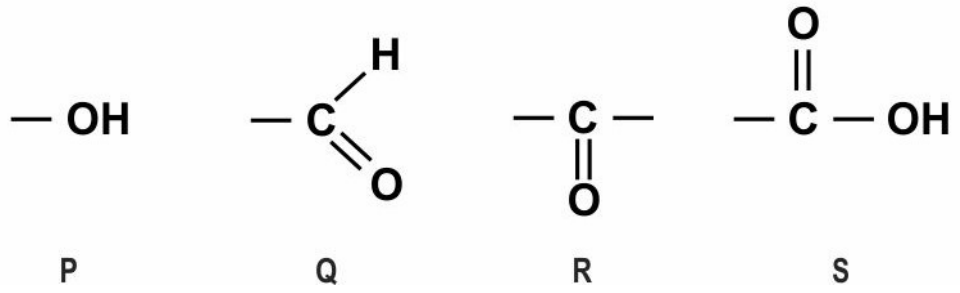
Q: 1 **On undergoing complete combustion in an adequate supply of oxygen, an organic compound produces only carbon dioxide and water vapour as the products.**

Based on this information, which of the following homologous series could the compound belong to?

P) alkanes
Q) alcohols
R) aldehydes

1 only P **2** only P or Q **3** only Q or R **4** any - P, Q or R

Q: 2 **A compound with which of the following functional groups is MOST LIKELY to cause the decomposition of baking soda to produce carbon dioxide?**



1 P **2** Q **3** R **4** S

Q: 3 **1 mole of ethene and 1 mole of ethyne are separately made to completely undergo addition reaction to form the respective saturated compound.**

Which of the following will be DIFFERENT for the two reactions?

P) the number of moles of the saturated compound formed
Q) the number of moles of the hydrogen consumed

1 only P **2** only Q **3** both P and Q **4** neither P nor Q

Q: 4 **Two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements A and R.**

Assertion (A): Vegetable oils are healthier than animal fats.
Reason (R): Vegetable oils generally have long unsaturated carbon chains while animal fats have saturated carbon chains.

1 Both A and R are true and R is the correct explanation for A.
2 Both A and R are true and R is not the correct explanation for A.
3 A is true but R is false.
4 A is false but R is true.

Q: 5 **[3]**

Alkanes are saturated compounds of carbon and hydrogen that can be represented by the general formula C_nH_{2n+2} where 'n' is the number of carbon atoms. An example of such a compound is ethane C_2H_6.

Maya has a compound of carbon and hydrogen whose formula is C_3H_4.

(i) What is true about the type of flame this compound will give on combustion?

(ii) Draw all the possible straight chain structures of this compound.

Q: 6 **[1]**

Bromine water is a reddish solution of bromine (Br_2) in water. When shaken with an unsaturated hydrocarbon, the red colour of the bromine water disappears because the bromine is used up in an addition reaction.

Kohli has three test tubes containing hexane, hexene and hexyne respectively. Which of the three compounds can he identify using the bromine water test? Give a reason for your answer.

Q: 7 **[3]**

A carbon compound of molecular formula $C_5H_{10}O$ contains a ketone functional group.

Draw the structures of three isomers of this compound having a ketone group.

Q: 8 **[3]**

Ethanol, C_2H_5OH is heated with alkaline potassium permanganate to give a compound X.

$$C_2H_5OH \xrightarrow{\text{alkaline } KMnO_4 + \text{heat}} X$$

(a) How many carbon atoms will compound X contain?

(b) Compound X is now reacted with ethanol in the presence of an acid catalyst to give a compound Y.

$$X + C_2H_5OH \xrightarrow{\text{acid}} Y$$

(i) Name the type of compound formed in the above reaction with respect to the functional group it contains.
(ii) State one characteristic property of compounds of the type of compound Y.
(iii) State one use of compounds of this type.

Q: 9 **Compounds with identical molecular formula but different structures are called structural isomers.** **[3]**

(a) In the case of saturated hydrocarbons, what is the MINIMUM number of carbon atoms needed in a molecule for it to have a structural isomer?
(b) Draw the structural isomers of the saturated hydrocarbon having the minimum number of carbon atoms mentioned in (a).

Q: 10 **An open-chain hydrocarbon X having the general formula of C_nH_{2n-2} is hydrogenated in the presence of a catalyst.** **[3]**

(a) State the number of moles of hydrogen required to completely saturate 1 mole of compound X.
(b) The hydrocarbon X contains carbon-carbon single bonds. Apart from the single bonds, state the number and the type of other carbon-carbon bonds that could possibly be present in the compound X.

Q: 11 **Shown below are the structural formulae of four carbon compounds.** **[3]**

$CH_3-\underset{\underset{O}{\|\|}}{C}-CH_3$	$CH_3-\underset{\underset{OH}{\|}}{CH}-CH_3$	$CH_3-CH_2-\underset{\underset{O}{\|\|}}{C}-OH$	CH_3-OH
P	Q	R	S

(a) Two of these compounds are more likely to have similar chemical properties. Identify these two compounds. Give a reason for your answer.
(b) Identify which of these compounds are likely to have the same boiling point. Justify your answer.

Q: 12 **Heating an alcohol with concentrated sulphuric acid results in the dehydration of the alcohol to give the alkene as shown by the reaction of ethanol to give ethene.** **[2]**

$$CH_3CH_2OH \xrightarrow{\text{Hot conc. sulphuric acid}} CH_2=CH_2$$

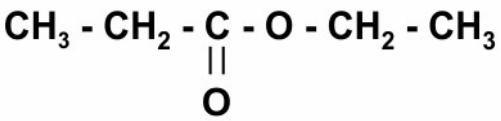
Pramila heated 2-butanol (shown below) with concentrated sulphuric acid.

$$CH_3CH_2\underset{\underset{OH}{|}}{C}HCH_3$$

Write the structural formulae of all the possible products of the reaction.

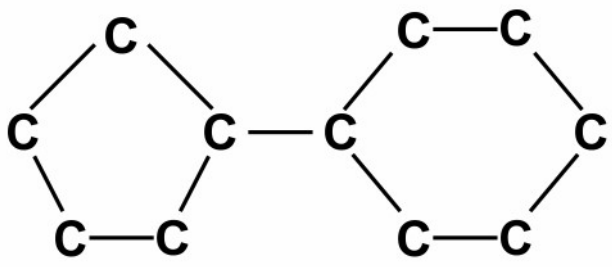
Q: 13 **Ethyl propanoate is a colourless compound with a pineapple-like smell. It is present naturally in some fruits such as kiwis and strawberries.** **[4]**

The structural formula of ethyl propanoate is given below.



(a) Write the names of the carboxylic acid and the alcohol from which this compound is formed.
(b) Apart from mixing the carboxylic acid and the alcohol, what should be done to form this compound?

Q: 14 **An alkane has 11 carbon atoms arranged within ring structures as shown below.** **[1]**



What is the molecular formula of the alkane?

Q: 15 **Manasi wrote the names of four compounds as the first members of their respective homologous series.** **[3]**

- methanol
- methanal
- methanone
- methanoic acid

(a) Which name has she written incorrectly? Justify your answer.
(b) What name should she have written instead?

Q: 16 **Organic compounds belonging to different homologous series can be isomers. For example, propanal and propanone are isomers.** **[2]**

Can an alkane and an alcohol be isomers? Why or why not?

Q: 17 **Home-made vinegar is produced from wine. The wine is taken in a clean glass jar and shaken well to aerate it. Some water is added to the jar and then it is kept undisturbed in a dark place at room temperature to undergo fermentation. After 3-4 weeks, the vinegar would be ready to use.** **[4]**

(a) Name the functional groups of the MAIN organic compounds present in wine and vinegar.
(b) Based on the atoms getting added/removed when wine is converted to vinegar, name the type of reaction that happens.
(c) Name any chemical reagent that would be used for the same reaction if it is carried out in the laboratory.

Q: 18 **Polythene is a plastic made from ethene ($CH_2=CH_2$). When ethene is subjected to high pressure and moderately high temperatures, ethene molecules react with each other to form large molecules hundreds of times bigger, forming the plastic.** **[1]**

Which property of carbon atoms is instrumental in the formation of polythene?

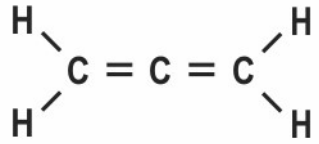
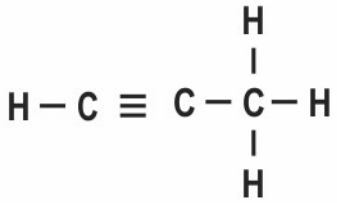
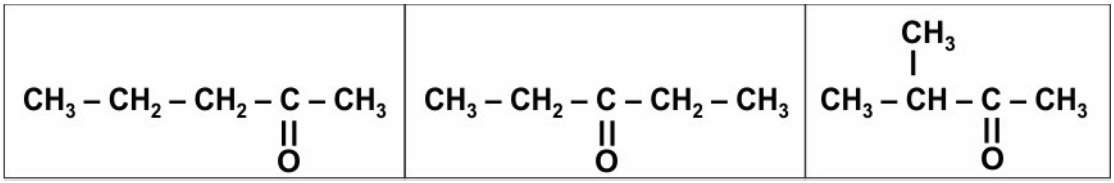
Q: 19 **Study the following information given and answer the questions that follow.** **[3]**

Ethanol is a renewable biofuel because it is made from biomass. Ethanol is a clear, colourless alcohol made from a variety of biomass materials. Ethanol producers mostly use food grains and crops with high starch and sugar content such as corn, sorghum, barley, sugar cane, and sugar beets. The most common ethanol production processes today use yeast to ferment the starch and sugars in corn, sugar cane, and sugar beets.

(a) What is the chemical formula for ethanol?
(b) What other compound is obtained as a by-product when ethanol is obtained from a sugar?
(c) What would be the products formed when ethanol undergoes complete combustion? Support your answer with a balanced chemical equation.

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	4
2	4
3	2
4	1

Q.No	Teacher should award marks if students have done the following:	Marks
5	(i) The compound being unsaturated will burn with a sooty or smoky flame.	1
	(ii) 1 mark each for the following:  	2
6	- hexane [0.5 marks] - Only hexane will not decolourise the bromine water. [0.5 marks]	1
7	1 mark for each of the following structures: 	3
8	(a) two	1
	(b) (i) ester [1 mark] (ii) sweet smell [0.5 marks] (iii) 0.5 marks for any of the following: - perfumes - flavouring agents (any other correct use should also be awarded full marks)	2

Q.No	Teacher should award marks if students have done the following:	Marks
9	(a) four	1
	(b) 1 mark each for the following isomers: $CH_3 - CH_2 - CH_2 - CH_3$ | $CH_3 - \underset{\displaystyle CH_3}{\underset{\vert}{CH}} - CH_3$	2
10	(a) 2 moles	1
	(b) 1 mark for each of the following: - two C-C double bonds - one C-C triple bond	2
11	(a) - Q and S [0.5 marks] - They have the same functional group. [1 mark]	1.5
	(b) - none of them [0.5 marks] - They are all different chemical substances. [1 mark]	1.5
12	1 mark each for the following: $CH_3CH = CHCH_3$ $CH_3CH_2CH = CH_2$	2
13	(a) 1 mark for each name: acid - propanoic acid / propionic acid alcohol - ethanol / ethyl alcohol	2

Q.No	Teacher should award marks if students have done the following:	Marks
	(b) 1 mark for each of the following: - add an acid catalyst - heat the reaction mixture	2
14	$C_{11}H_{20}$	1
15	(a) 1 mark for each of the following: - methanone - The smallest ketone has three carbon atoms. OR There is no compound named methanone.	2
	(b) propanone	1
16	1 mark for each of the following points: - No, they cannot be isomers. - Alkanes have only carbon and hydrogen atoms, while alcohols have oxygen atoms too.	2
17	(a) 1 mark for each of the following: wine - hydroxyl / alcohol / -OH vinegar - carboxyl / carboxylic acid / -COOH	2
	(b) oxidation	1
	(c) any oxidising agent such as: - potassium permanganate / $KMnO_4$ - potassium dichromate / $K_2Cr_2O_7$	1
18	catenation OR the ability of carbon atoms to link with each other to form long chains	1

Q.No	Teacher should award marks if students have done the following:	Marks
19	(a) CH_3CH_2OH	0.5
	(b) carbon dioxide / CO_2	0.5
	(c) carbon dioxide and water / CO_2 and H_2O [0.5 mark for each product] $CH_3CH_2OH + 3\ O_2 \rightarrow 2\ CO_2 + 3\ H_2O$ [1 mark]	2

Chapter - 5
Periodic Classification of Elements

Q: 1 **Two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements A and R.**

Assertion (A): In the periodic table, atomic size increases from left to right across a period.

Reason (R): In the periodic table, the number of valence shell electrons increases on moving from left to right across a period.

1 Both A and R are true and R is the correct explanation of A.
2 Both A and R are true but R is not the correct explanation of A.
3 A is true but R is false.
4 A is false but R is true.

Q: 2 **Can tritium (T) which is an isotope of hydrogen (H) be placed in the periodic table? If yes, then in which position?**
Justify your answer. **[2]**

Answer the following questions based on the given information.

Electronegativity is defined as the tendency of an atom in a molecule to attract the shared pair of electrons towards itself.

In 1932, chemist Linus Pauling developed a scale to compare the electronegativities of different elements. Given below are the electronegativities of the first 20 elements of the periodic table, according to the Pauling scale.

H 2.20							He
Li 0.98	Be 1.57	B 2.04	C 2.55	N 3.04	O 3.44	F 3.98	Ne
Na 0.93	Mg 1.31	Al 1.61	Si 1.90	P 2.19	S 2.58	Cl 3.16	Ar
K 0.82	Ca 1.00						

Q: 3 **Which type of bond is likely to be formed between atoms of elements with electronegativities 3.44 and 2.58? Justify your answer.** **[2]**

Q: 4 **Why do the noble gases in the rightmost group NOT have an electronegativity value on the Pauling scale?** **[1]**

Answer the following questions based on the given information.

A part of Dimitri Mendeleev's periodic table from the 1860s is shown below.

Group	I	II	III	IV	V	VI	VII	VIII
Oxide Hydride	R_2O RH	RO RH_2	R_2O_3 RH_3	RO_2 RH_4	R_2O_5 RH_3	RO_3 RH_2	R_2O_7 RH	RO_4
Periods ↓	A B	A B	A B	A B	A B	A B	A B	Transition series
1	H 1.008							
2	Li 6.939	Be 9.012	B 10.81	C 12.011	N 14.007	O 15.999	F 18.998	
3	Na 22.99	Mg 24.31	Al 29.98	Si 28.09	P 30.974	S 32.06	Cl 35.453	
4 First series: Second series:	K 39.102 Cu 63.54	Ca 40.08 Zn 65.37	Sc 44.96 Ga 69.72	Ti 47.90 Ge 72.59	V 50.94 As 74.92	Cr 50.20 Se 78.96	Mn 54.94 Br 79.909	Fe Co Ni 55.85 58.93 58.71

Q: 5 **(a) Which family of elements that constitutes a group in the modern periodic table is completely missing in this table?** **[1]**
(b) Give one example from this family of elements.

Q: 6 **Which property of elements does Mendeleev use for classifying elements when he refers to the formula of oxides and hydrides indicated in the top row?** **[1]**

Q: 7 **Name the property of elements which is the basis of the modern periodic table, but was NOT used by Mendeleev to make his periodic table.** **[1]**

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	4

Q.No	Teacher should award marks if students have done the following:	Marks
2	- Yes, it can be placed in the periodic table. [0.5 marks] - at the same position as hydrogen [0.5 marks] - Elements are arranged in the periodic table according to atomic number. [0.5 marks] - Tritium has the same atomic number as hydrogen. [0.5 marks]	2
3	1 mark for type of bond: - covalent bond 1 mark for either of the following reasons: - The two elements are both non-metals. - Neither or the two elements can lose electrons easily. *(Any other valid reason can be accepted.)*	2
4	1 mark for any of the following: - They do not react with other elements. - They do not form bonds with other elements.	1
5	0.5 marks for each of the following: - noble gases / inert gases - helium / neon / argon / krypton / xenon / radon	1
6	valency	1
7	1 mark for either of the following: - atomic number - electronic configuration	1

Chapter - 6
Life Processes

Q: 1 **Two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements A and R.**

Assertion (A): Warm-blooded animals have their left and right side of the heart separated for more efficient supply of oxygen to the body.
Reason (R): Warm-blooded animals need high energy to maintain their body temperatures.

1. Both A and R are true and R is the correct explanation for A.
2. Both A and R are true but R is not the correct explanation for A.
3. A is true but R is false.
4. A is false but R is true.

Q: 2 **Haemoglobin and Chlorophyll have similar structures.**

- A molecule of haemoglobin is composed of the atoms of four elements- carbon, hydrogen, oxygen and nitrogen, all four organised around iron.
- A chlorophyll is composed of the same elements, which are organised around magnesium.

Considering the above information, which element of haemoglobin is MOST LIKELY responsible for the red colour of our blood?

1. hydrogen
2. nitrogen
3. carbon
4. iron

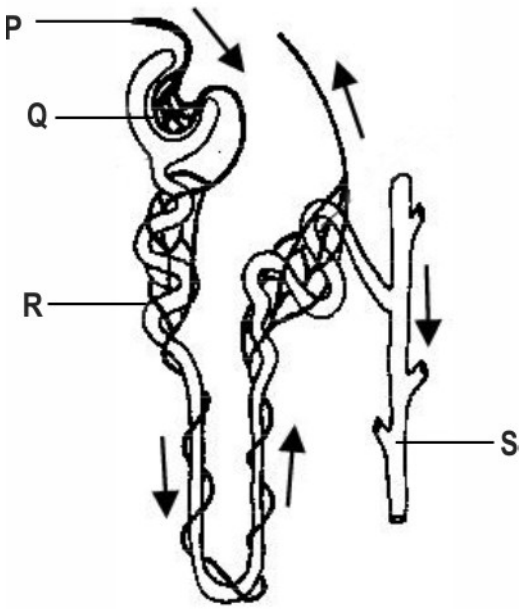
Q: 3 **Many processes happen in the bodies of living organisms.**

Those processes which involve the building up of complex molecules from simpler ones are called anabolism. Those which involve the breakdown of complex molecules into simpler ones are called catabolism.

Which of the following life processes can be considered as an example of anabolism?

1. digestion
2. respiration
3. transpiration
4. photosynthesis

Q: 4 **Given below is a diagram of a nephron.**



Which row of the following table correctly shows where filtration and selective reabsorption occur?

	Filtration	Selective reabsorption
1	P	Q
2	Q	S
3	Q	R
4	P	R

Q: 5 **Which row in the table below shows the correct products of anaerobic respiration in humans and in yeast?**

	humans	humans	yeast	yeast
	lactic acid	carbon dioxide	lactic acid	carbon dioxide
1	X	√	X	X
2	√	X	X	√
3	X	√	√	X
4	√	√	√	X

Q: 6 **Read the following two statements and answer the question.**

1. Gastroparesis is a disease in which the muscles of the stomach become paralysed and cannot contract or relax.
2. Foods high in fat can delay the process of digestion and the emptying of the stomach.

Which of the following food would be advised to a patient suffering from gastroparesis?

1 soups and juices only
2 soups and chicken salads only
3 fried chicken and fried rice
4 ice cream and milk only

Q: 7 **Which row of the table given below correctly gives the movement of gases across blood and cells?**

	Oxygen	Carbon dioxide				
	from	**to**	**process**	**from**	**to**	**process**
1	RBC	cells	diffusion	cells	RBC	osmosis
2	RBC	cells	osmosis	cells	plasma	osmosis
3	RBC	cells	osmosis	cells	RBC	diffusion
4	RBC	cells	diffusion	cells	plasma	diffusion

1 P **2** Q **3** R **4** S

Q: 8 **Read the following statements.**

X: amount of carbon dioxide produced per molecule of glucose during aerobic respiration
Y: amount of carbon dioxide produced per molecule of glucose during fermentation by yeast

Which of the following is TRUE about X and Y?

1 X is more than Y.
2 X is less than Y.
3 X is equal to Y.
4 (Cannot be determined.)

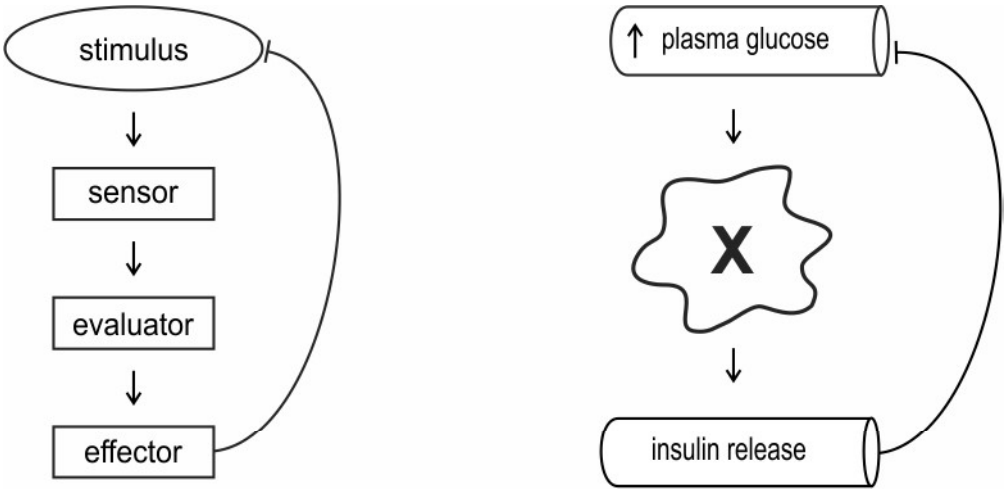
Q: 9 **Human beings exhibit 'double circulation' during which blood is passed through the lungs and heart.** **[3]**

(a) State the route of the first and the second circulation through the chambers of the heart and explain the usefulness of such circulation in humans.

(b) Name the blood vessels that:
(i) carry oxygenated blood from the lungs to the heart
(ii) carry deoxygenated blood from the heart to the lungs

Q: 10 **A major portion of the carbohydrates produced by plants is stored in different parts of the plant (storage organs). Explain the mechanism by which this stored food is made available when different organs need it for growth.** **[2]**

Q: 11 **In human beings, hormonal action is largely controlled by a mechanism where the secretion of one hormone is regulated by the action of another. An example of blood glucose levels control is shown in the diagram below.** **[2]**



(a) What is the mechanism of hormone action known as?
(b) Which is the sensor X that helps in detecting blood glucose level?
(c) What would happen if such mechanism is absent in humans?

Q: 12 **Not all plants carry out photosynthesis by the same mechanism. In most plants, photosynthesis depends directly on the gaseous carbon dioxide that diffuses into the leaf through the stomata.** **[4]**

However, some plants - such as pineapple - have the ability to store carbon dioxide in the vacuoles of the leaf cells as part of a complex carbon compound. This complex compound is transported to the chloroplasts and releases carbon dioxide when required, for photosynthesis to occur.

This special photosynthesis mechanism is believed to have evolved as an adaptation to conserve water for survival in dry conditions.

(a) Which process in the plants does this photosynthesis mechanism minimise to help the plant survive in dry conditions?

(b) How is the ability to store carbon dioxide as a complex compound likely to help minimise the process referred to in (a)?

(c) When are such plants likely to take in carbon dioxide from the environment?

Q: 13 **When some particles (like sand or dust) fall into our eyes, our eyes start to water on their own and we blink to get the particle out of our eyes. This is a type of reaction to a stimulus that the human body shows.** **[2]**

(a) Is the above-mentioned reaction involuntary or voluntary?

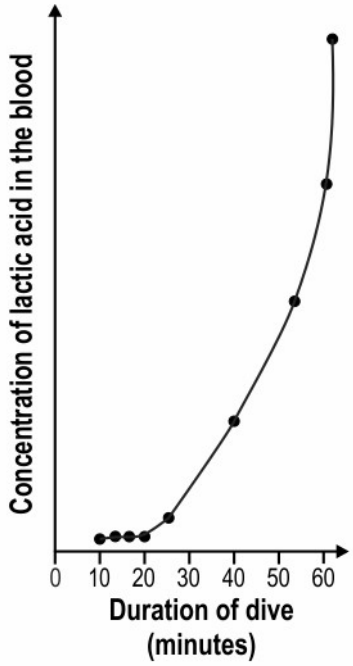
(b) What is the specific name given to the pathway that brings about this immediate reaction to a stimulus?

(c) What are the names given to:
(i) the organ that responds to a stimulus
(ii) the part of the brain that receives sensory impulses

Q: 14 **A Weddell seal, a deep-sea diving mammal, has special adaptations that enable it to respire for long periods under water without inhaling air. Three such adaptations are given below.** **[5]**

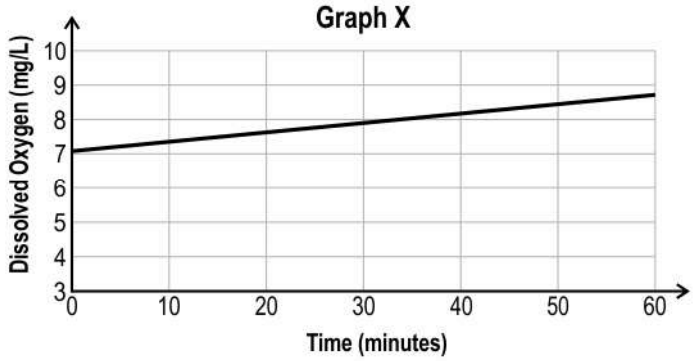
P) When diving, the blood flow to all parts of the seal's body is reduced by 80-95%, except for a closed circuit between the lungs, heart and brain.
Q) 70% of the oxygen in the seal's body is stored in the blood (in hemoglobin), as compared to just 51% in humans.
R) 25% of the oxygen in the seal's body is stored in the muscles (in myoglobin), as compared to just 13% in humans.

In 1980, a group of scientists carried out an experiment to understand how a Weddel seal respires under water during dives of different durations. After each dive completed by the seal, they measured the concentration of lactic acid in the seal's blood. The graph below represents the data obtained by the scientists.

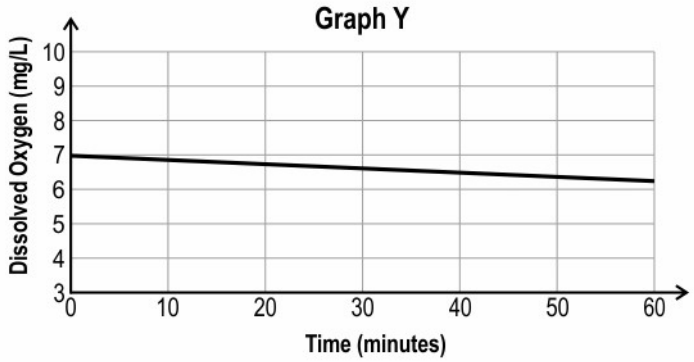


(a) Based on the graph, what can be inferred about the CHANGE in the respiration happening in the seal's body after 20 minutes under water? Justify your answer.
(b) Adaptation R helps the seal the most to produce energy for SWIMMING during the first 20 minutes of a dive. Explain why adaptations P and Q do not help as much.

Q: 15 **Anita conducted an experiment to examine photosynthesis in aquatic plants kept in a tank by measuring dissolved oxygen. She plotted her results in the following graph X:** **[4]**



She repeated the experiment while covering the tank with an opaque black cloth. She plotted the results in the following graph Y:



(a) What could be the aim of her experiment?
(b) Apart from photosynthesis, what other cellular process can be observed by the experiment?
(c) Why does the oxygen level rise in graph X?
(d) Explain the downward slope of the graph Y.

Q: 16 **Terrestrial animals use lungs to breathe while aquatic animals like fishes use gills to absorb dissolved oxygen in water. Frogs are organisms that can survive both in water and on land.** **[3]**

(a) How does a frog acquire oxygen while it is underwater?
(b) Are lungs of terrestrial animals and gills of fishes analogous organs? Explain why or why not.
(c) Why do aquatic animals have a higher breathing rate than terrestrial animals?

Q: 17 **The image below shows the cross section of a blood vessel of a human arm.** **[2]**

(a) What is the type of blood vessel shown in the image?
(b) Which direction will the blood flow in such a blood vessel?

Q: 18 **We often hear people complain about 'acidity' in the stomach.** **[3]**

(a) Overproduction of what substance is most likely the reason for the complaint?
(b) Why is the production of this substance necessary?
(c) How does the stomach prevent itself from the harmful effects of overproduction of the substance?

Q: 19 **There are various muscles present in the human digestive system known as sphincters. Two examples of those are given below:** **[2]**

1. pyloric sphincter - at the junction of stomach and small intestine
2. anal sphincter - at the anus

Give ONE most likely consequence of malfunctioning of each of these sphincters.

Q: 20 **The developing human embryo gets nutrition from the mother through a special tissue called placenta.** **[3]**

(a) Mention TWO structural designs of the placenta that help the embryo to get nutrition.
(b) Is the placental tissue designed for one way transport? Justify your answer.

Q: 21 **Arthropods and molluscs have a copper-containing respiratory pigment called hemocyanin while human beings have iron-containing hemoglobin.** **[2]**

(a) How do respiratory pigments help in the process of respiration?
(b) Why do multicellular animals need a respiratory pigments?

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	1
2	4
3	4
4	3
5	2
6	1
7	4
8	1

Q.No	Teacher should award marks if students have done the following:	Marks
9	(a) - During first circulation: oxygenated blood from lungs come to the left atrium to left ventricle to pass to the body - During second circulation: deoxygenated blood from body comes to right atrium and then right ventricle to pass for oxygenation to the lungs again. [0.5 marks for each point] -allows for separation of oxygenated and deoxygenated blood in the body [1 mark]	2
	(b) 0.5 marks for each correct answer: (i) pulmonary vein (ii) pulmonary artery	1
10	0.5 marks for each point: - Sugar from storage organ is moved to phloem using ATP/energy. - This increases osmotic pressure of phloem. - This results in intake of water into the phloem. - Increased pressure inside the phloem cells moves sugar to cells with lower pressure to reach other organs.	2
11	(a) feedback mechanism	1
	(b) beta cells OR cells of the pancreas	1
	(c) Balance of life processes would be disturbed in the human body.	0
12	(a) transpiration	1
	(b) 1 mark for each of the following points: - Since stored carbon dioxide can be used, stomata need not be open for photosynthesis to occur during the day. - Keeping the stomata closed during the day helps to minimise water loss due to transpiration.	2
	(c) during the night	1
13	(a) involuntary	0.5

Q.No	Teacher should award marks if students have done the following:	Marks
	(b) reflex arc	0.5
	(c) 0.5 marks for each correct answer: (i) effector (ii) forebrain	1
14	(a) Respiration is mostly aerobic in the first 20 minutes, and mostly anaerobic after the first 20 minutes. [1 mark] Justification: - Lactic acid is a product of anaerobic respiration. [1 mark] - The sharp rise in lactic acid concentration after 20 minutes indicates anaerobic respiration happening after 20 minutes. [1 mark]	3
	(b) 1 mark for each point: - Most of the energy needed for swimming is produced by the muscles. - Since most of the blood does not reach the muscles during a dive, the oxygen stored in the blood is not as useful for swimming as the oxygen stored in the muscles.	2
15	(a) to show that light is necessary for photosynthesis	1
	(b) respiration	1
	(c) In the presence of light, the plants performed photosynthesis which released oxygen at a higher rate than the rate of oxygen utilisation by respiration. Hence the oxygen levels rise.	1
	(d) The downward slope depicts that dissolved oxygen is used up by the plant for respiration but no new oxygen is produced as the plant does not perform photosynthesis in absence of light.	1
16	(a) Frog's skin is thin and permeable to oxygen and water. [0.5 marks] It takes up the dissolved oxygen from the water through the process of diffusion. [0.5 marks]	1

Q.No	Teacher should award marks if students have done the following:	Marks
	(b) Yes, they are analogous organs. [0.5 marks] Because they have different structure but similar function. [0.5 marks]	1
	(c) Amount of dissolved oxygen in water is lower as compared to oxygen present in the air. Hence aquatic animals have to breathe faster.	1
17	1 mark for each correct answer: (a) vein (b) from P to Q	2
18	(a) hydrochloric acid	1
	(b) It creates an acidic medium for functioning of enzyme pepsin.	1
	(c) The stomach also produces mucus that coats the lining to prevent damage by hydrochloric acid.	1
19	1 mark for each consequence such as: - pyloric sphincter : food getting into small intestine too fast causing poor absorption / poor digestion - Anal sphincter : involuntary release of feces from the body	2
20	(a) 1mark for each correct point: - It has villi on the embryo side. - It has blood spaces on the mother's side.	2
	(b) No, the waste generated by the developing embryo is transferred out through the placental tissue.	1
21	(a) Respiratory pigments combine with oxygen and help in transport of oxygen throughout the body.	1

Q.No	Teacher should award marks if students have done the following:	Marks
	(b) When the body size of animals is large, diffusion pressure alone cannot take care of oxygen delivery to all parts of the body. Hence,respiratory pigments take up oxygen from the air in the lungs and carry it to tissues which are deficient in oxygen.	1

Chapter - 7
Control and Coordination

Q: 1 **Sapna suffers from a condition due to which her average blood sugar level is 174 mg/dL. The average blood sugar level in a healthy adult is <140 mg/dL.**

Which of the following could be the cause of Sapna's condition?

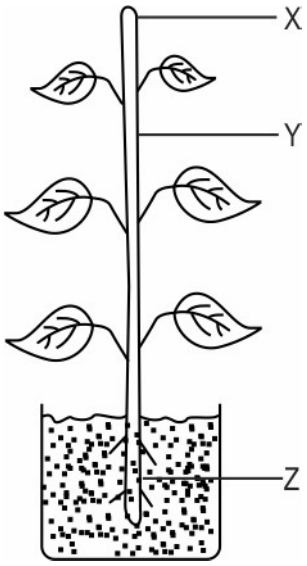
1. insufficient production of thyroxine in her body
2. insufficient production of insulin in her body
3. excess production of thyroxine in her body
4. excess production of insulin in her body

Q: 2 **Auxin is a plant hormone that promotes cell elongation and is produced by the apical meristem. It inhibits the growth of lateral buds which are present at nodes (where leaves attach to the stem). As long as sufficient auxin is produced by the apical meristem, the lateral buds remain dormant.**

A gardener wants the plants in the hedge that he is growing to become bushier with more branches. Which of the following should he do?

1. spray water on the tips of the stems to increase growth
2. dig around the plant roots and apply more manure
3. trim the hedge by cutting off the tips of the stems
4. remove all the weeds that grow around the hedge

Q: 3 **Shown in the figure below is a plant in which auxin is synthesised at part X of the plant. Geeta took the potted plant and cut off part X. She then took the plant and kept it near a window with sunlight and observed it after 7 days.**



Which of the following is she likely to have observed?

1. Part Y grew and bent towards the window.
2. Part Z started growing upwards and out of the soil.
3. Part Y did not grow at all.
4. Part Y grew upwards.

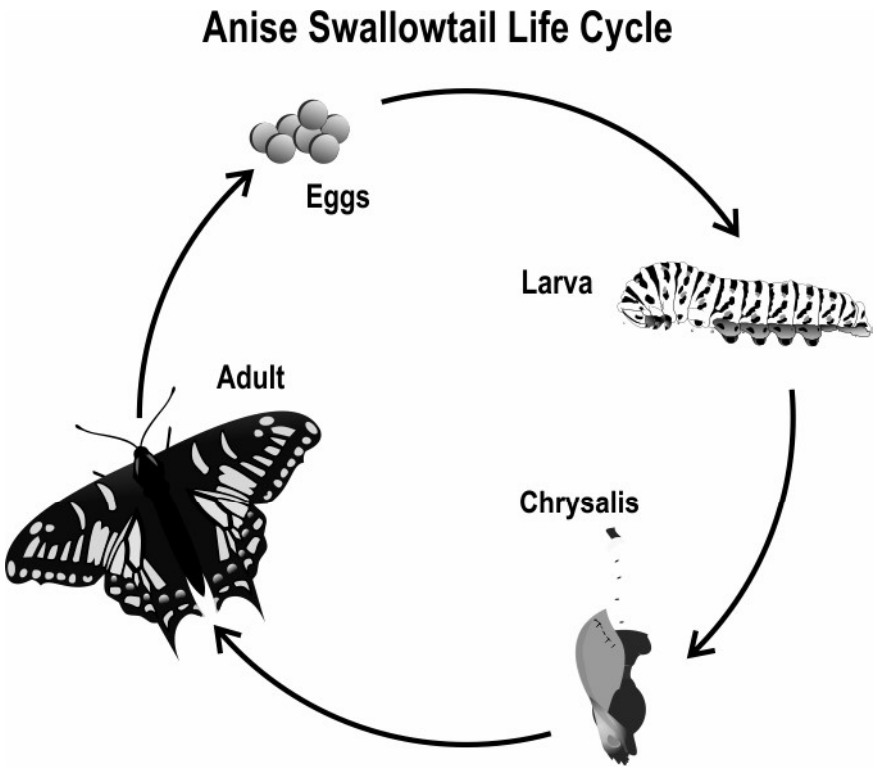
Q: 4 **During pollination, plants ensure that the pollen grain from a species germinates on the stigma of the same species.**

Which of the following ensures this?

1 hydrotropism **2** chemotropism **3** phototropism **4** geotropism

Q: 5 **Metamorphosis is a biological process by which an animal physically develops after birth or hatching, involving a conspicuous and relatively abrupt change in the animal's body structure through cell growth and differentiation. Some insects, fish, amphibians, molluscs, crustaceans and other groups undergo metamorphosis, which is often accompanied by a change of nutrition source or behaviour.** **[2]**

The diagram below shows such metamorphosis in butterflies.



(a) What are the chemicals that control such developmental changes in the butterfly's body structure called?
(b) Name ONE developmental change (other than external changes in body structure) in a human female during puberty brought about by the action of the type of chemicals mentioned in (a).
(c) What is the most likely genetic difference between the larval and adult stages in the life cycle of the butterfly shown above?

Q: 6 **(a) As first line of defense, stress hormones are released in humans. As an equivalent, which hormone is most likely to be released as first line of defense in plants?** **[2]**
(b) There have been reports of plant hormones being found in animal bodies even when they are not synthesised by the animal. What can be the most common pathway of entry of such hormones in animals?

Q: 7 **(a) Name ONE plant hormone that controls directional growth.** **[2]**
(b) Plant hormones are also referred to as growth regulators and can be controlled by a number of stimuli. Mention ONE point of difference between the functioning of animal growth hormones and plant growth regulators with respect to such control.

Q: 8 **Sheila saw a snake and instantly jumped back. She then slowly moved away from the snake.** **[1]**

What is the difference between the two actions of instantly jumping and walking away?

Q: 9 **Hema bought some unripe tomatoes and left half of them in a brown paper bag and the other half in an open tray. After two days she noticed that the tomatoes in the paper bag had ripened, but the ones in the open tray had not.** **[2]**

(a) What hormone facilitated the ripening of tomatoes?
(b) Why did the tomatoes in the paper bag ripen faster?

Q: 10 **While on a roller coaster ride, Aditya noticed an increase in his heartbeat and his breathing. Which hormone is responsible for the changes in Aditya's body?** **[1]**

Q: 11 **'Plant growth regulators do not always promote growth.'** **[1]**

Cite one example in support of the above statement and mention the action of the same.

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	2
2	3
3	3
4	2

Q.No	Teacher should award marks if students have done the following:	Marks
5	(a) hormones	0.5
	(b) onset of menstrual cycle	0.5
	(c) There is no genetic difference in the larval and adult stages if the butterfly.	1
6	(a) Abscisic acid/ ABA	1
	(b) through food	1
7	(a) auxin	1
	(b) Animal growth hormones cannot promote growth under the influence of external stimuli like light, gravity etc.while plant growth regulators do.	1
8	The jump was an involuntary quick reflex action. [0.5 marks] Walking away was a voluntary slow action. [0.5 marks]	1
9	(a) ethylene	1
	(b) Ethylene is a gaseous hormone and the paper bag prevented it from diffusing into the air. Hence the tomatoes ripened faster.	1
10	adrenaline	1
11	0.5 marks for each correct point: - abscissic acid - promotes ageing and senescence	1

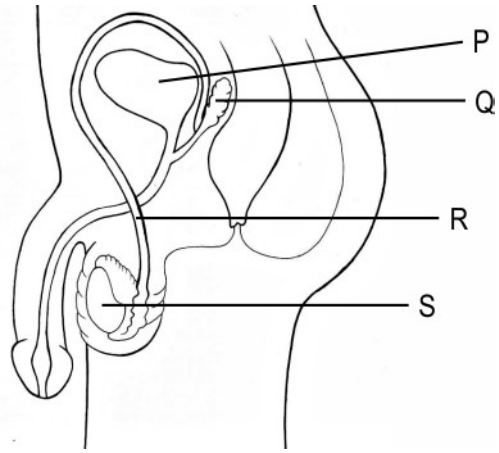
Chapter - 8
How Do organisms Reproduce?

Q: 1 **Two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements A and R.**

Assertion (A): Oral contraceptive pills and copper-T do not prevent sexually transmitted diseases.
Reason (R): Sexually transmitted disease are transmitted by contact with mucous membranes of infected organs.

1 Both A and R are true and R is the correct explanation of A.
2 Both A and R are true but R is not the correct explanation of A.
3 A is true but R is false.
4 A is false but R is true.

Q: 2 **The diagram below represents the male human reproductive system.**



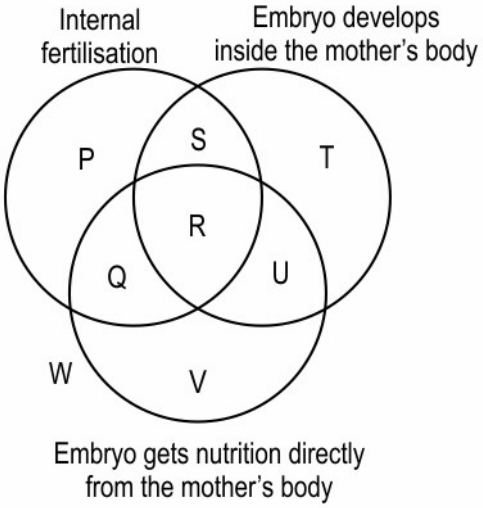
Identify the part that is responsible for the secretion of testosterone.

1 P **2** Q **3** R **4** S

Q: 3 **"The biological sex of an individual only depends on the sperm cell."** **[1]**

Is the above statement true or false? Justify your answer.

In the diagram below, each labelled region (P to W) represents a certain combination of reproductive processes found in an animal. Each labelled region is characterised by the different circles that it is (or is not) a part of.



Answer the following questions based on this diagram.

Q: 4 **Name any one animal whose mode of reproduction is represented by region P.** **[1]**

Q: 5 **The description of a species of fish called 'guppy' is given below:** **[2]**

"Guppies are live-bearing fish, with a gestation period of 21-30 days. Once inseminated, female guppies can store sperm in their ovaries, which can continue to fertilize ova up to eight months, meaning the female mate can give birth to the male's offspring long after the male's death."

(a) Based on the given information, which labelled regions CAN guppies belong to?
(b) What additional information is required to identify the labelled region in the diagram that guppies ACTUALLY belong to?

Q: 6 **'In vitro fertilisation' is a process of fusing a human egg and sperm outside a woman's body, in a laboratory. After fertilisation, the zygote is allowed to develop into an embryo for 2-6 days. The embryo is then implanted in the woman's uterus, where it develops normally.** **[1]**

Which labelled region in the diagram BEST represents reproduction via in vitro fertilisation?

Bindu wants to produce a hybrid variety of tomatoes. She has tomato plants X and Y belonging to two different varieties, one with smooth, long fruits and the other one with wrinkled, round fruits.

Tomatoes have bisexual flowers. Bindu carries out the following steps carefully to cross pollinate the flowers of plants X and Y:

1. She removes a part of the flowers of tomato plant X just before the flowers bloom.
2. She manually pollinates the flowers of tomato plant X using pollen from the flowers of tomato

plant Y.
3. She ties small plastic bags around the pollinated flowers of tomato plant X. The plastic bags are removed after a couple of days.

Q: 7 **Bindu carried out step 1 so as to prevent self-pollination. Which part did she remove?** **[1]**

Q: 8 **Plants produced through vegetative propagation are genetically identical to their parents.** **[1]**

What could be the biggest disadvantage of vegetative propagation?

Q: 9 **A farmer bought some strawberries and liked the taste. He decided to grow his own strawberries that should have the same taste.** **[2]**

(a) Which method of cultivation should the farmer adopt?
(b) Why would the farmer choose this method?

Q: 10 **What could be the TWO most likely reasons for unicellular organisms to reproduce only through asexual reproduction?** **[2]**

Q: 11 **Planarians can regenerate lost body parts due to the presence of specialised cells called neoblasts. These specialised cells multiply and make a large mass of cells from which different cells undergo changes to become different types of cells and tissues.** **[3]**

(a) In plants, in which type of tissue are cells that have a function similar to neoblasts found?

(b) How do the characteristics of a planarium formed by regeneration compare with the characteristics of the original planarium? Justify your answer.

The table below gives the correct answer for each multiple-choice question in this test.

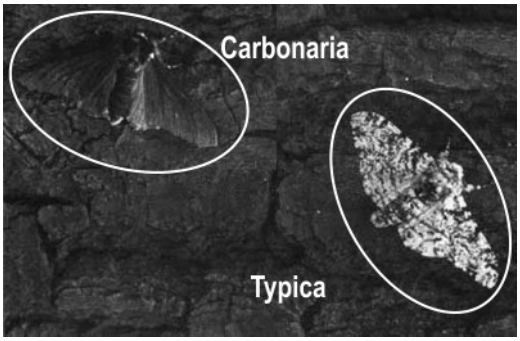
Q.No	Correct Answers
1	1
2	4
3	1

Q.No	Teacher should award marks if students have done the following:	Marks
4	True. All egg cell contains only X chromosome. It is the sperm that may contain an X or a Y chromosome and so depending on which sperm unites with the egg, the biological sex of the individual is determined.	1
5	Any animal that lays eggs after internal fertilisation such as birds, lizards, etc.	1
6	(a) R or S [0.5 marks for each] (b) whether the embryo gets nutrition directly from the mother's body [1 mark]	2
7	U	1
8	stamens/anthers	1
9	1 mark for any disadvantage such as: - Both the parent plant and the progeny will be susceptible to same pathogen which can wipe out the entire population. - less genetic diversity as no new variety will be produced	1
10	(a) asexual reproduction / vegetative propagation	1
	(b) because fruit produced through vegetative propagation would carry conserved parental characteristics	1
11	1 mark each for any two reasons such as: - They can produce a large number of offsprings in a small period of time. - The offsprings are adapted to survive in the same environment.	2
12	(a) meristematic tissue	1
	(b) 1 mark each for the following: - They will be the same. - Regeneration does not involve the mixing of gametes.	2

Chapter - 9
Heredity and Evolution

"In the early part of the nineteenth century, the common form of *Biston betularia*, called *typica*, had a peppered appearance. Its wings were flecked with black and white, and it was well camouflaged in its favourite resting place, the pale and lichen-covered barks of trees in rural England. A dark, or melanistic, form of the moth, called *carbonaria*, was first recorded in about 1848, and presumably had existed in very small numbers before then. But by the middle of the twentieth century, the melanistic form of the moth had come to represent over 95 percent of the *Biston betularia* population, especially in such industrial centers as Manchester and Liverpool. This is among the most rapid of all recorded evolutionary changes. Why was there such a dramatic change in fortunes of the peppered *typica* and the melanistic *carbonaria*? With rapid industrialisation, soot came to cover the barks of trees, making them black instead of pale, and also killed the lichens. Now the melanistic form was better camouflaged on the darkened bark, while the peppered form became increasingly less camouflaged and hence more easily detected and eaten by birds. The birds, which had kept the melanistic form at a very low frequency before industrialisation, now concentrated their attention on the peppered form. Natural selection, in the form of bird predation, favoured the peppered form earlier and the melanistic form later."

-Excerpt from Survival Strategies, by Raghavendra Gadagkar.



Q: 1 Where did the variations seen in the appearance of the moth most likely come from?

1. The moths changed their appearance based on what was good for their survival.
2. The environment caused genetic changes in the moths, making them look different.
3. Random genetic changes and different combinations of genes arising at the time of reproduction led to the differing appearances.
4. Selective breeding between the most adapted moths and rapidly changing environment created a variety of moth appearances.

Q: 2 Which of the following correctly describes what is most likely to be passed on from a moth to its offspring?

1. the strategy the parent moth learns to escape from the predator bird
2. the newer patterns produced on the wings due to genetic changes
3. the tactics used to gather more food
4. (None of the above can be passed on from a moth to its offspring.)

Q: 3 **In 1956, strict anti-pollution laws were enacted in England, which led to the countryside becoming relatively less polluted and free of smoke. One of the following was observed in 20 years from this event and is believed to be linked to this event. Which one could it be?**

1 The number of the melanistic form dropped significantly.
2 The number of the melanistic form increased significantly.
3 The melanistic and peppered forms evolved into a single new form.
4 The melanistic and peppered forms became extinct from the countryside.

Q: 4 **Select the option that correctly summarises the given observations in the passage.**

1 Majority of the peppered moths changed their appearances to become melanistic moths so that they could survive.
2 The predator birds help in controlling the number of any given type of moth so that neither one gets an undue advantage of survival.
3 Different types of moths had to continuously make efforts to adapt themselves in order to survive in the changing environmental conditions.
4 It is by chance that different types of moths were present at any given point of time and the environmental factors determined which type got a survival benefit.

Q: 5 **Attached earlobes in humans is an inherited condition. The allele for attached earlobes is recessive.**

What are the chances of parents, both having attached earlobes, to have a child with attached earlobes?

1 0% **2** 25% **3** 75% **4** 100%

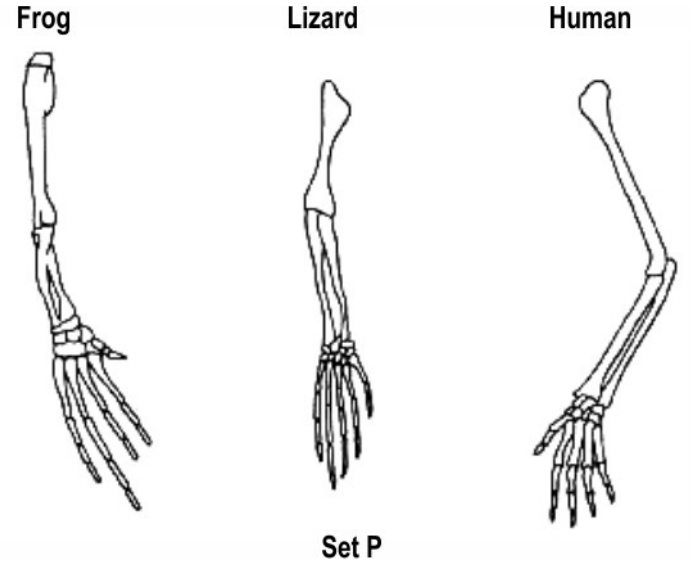
Q: 6 **A monohybrid cross is conducted between one variety of pea plants having pods that are full (FF) and another having pods that are constricted (ff).**

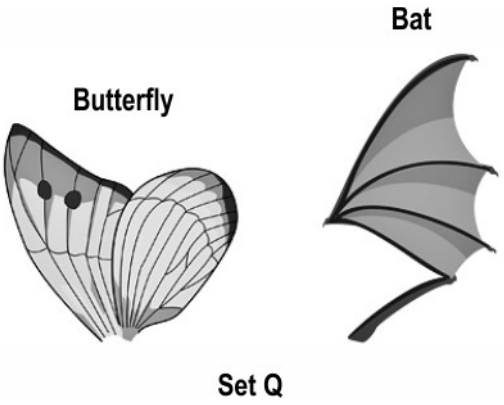
What is the percentage of heterozygous offsprings in F1 generation?

1 100% **2** 75% **3** 50% **4** 25%

Q: 7 **Evolution in living organisms can be understood by studying the characteristics of different species. These characteristics can be different or similar based on their ancestors.** **[3]**

Given below are pictures of two sets P and Q, of organs of different species. Each set is grouped based on the evolution of these organs in different species.





(a) Name the scientific terms that describe the evolutionary relationship of the organs in sets P and Q.
(b) What are the differences between the two sets of organs?

Q: 8 **As part of a theatrical presentation on tracing evolutionary evidences, two teams of class 10 dressed up as the following:** **[3]**

Team P: One person each dressed as a cat and a dolphin to show the cat's leg and a dolphin's flippers as homologous organs.
Team R: One person each dressed as an insect and a bird to show the insect's wings and the bird's wings as homologous organs.

(a) Define homologous organs.
(b) Which of the two teams should win the presentation for correct depiction?
(c) What is incorrect about the losing team's presentation?
(d) Apart from such anatomical connections, name TWO other sources of evidence of evolution used by us.

Q: 9 **"*Sex determination is an important developmental event in the life cycle of all sexually reproducing plants. Recent studies of sex determination in many plant species, from ferns to maize, have been fruitful in identifying the diversity of genetic and epigenetic factors that are involved in determining the sex of the flower or individual.*"** **[5]**

The above is an excerpt from an article by two scientists Cristina Juarez and Jo Ann Banks.

(a) What is the most likely genetic factor for sex determination in unisexual plants?
(b) Epigenetic factors refer to factors external to the genetic component of an individual. Name evidence of ONE epigenetic condition that determines sexuality in animals.
(c) State Mendel's law of segregation and explain how sex determination violates the law.
(d) Which parent determines the sex of the offspring in human beings? Why?

Q: 10 **Consider a pea plant that is recessive for plant height. Its 'genotype' is tt and 'phenotype' is dwarf.** **[5]**

(a) Assuming that the gene for plant height obeys the Mendel's laws of inheritance, indicate the genotypes and phenotypes of ALL the possible parent pairs that could have dwarf offspring.

(b) Using any of the parent pairs mentioned by you in (a), perform a cross to show the genotypes of the offspring that might arise in the next generation.

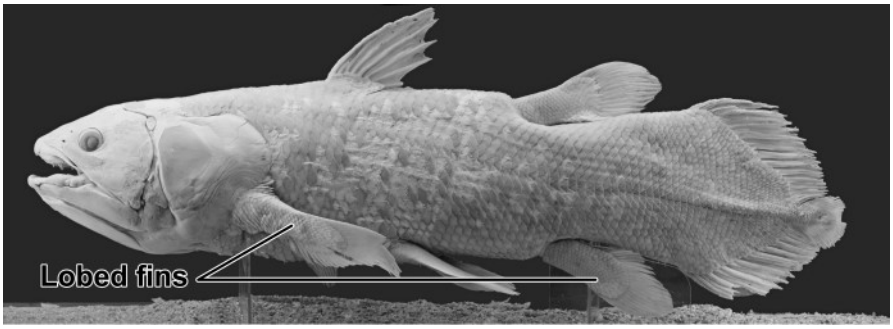
Q: 11 **Two tall pea plants are used to produce a progeny of 20 pea plants. The two parent plants have a genotype of TT and Tt respectively.** **[1]**

How many short pea plants will be found in the progeny in the F1 generation?

Answer the following questions based on the given information.

Coelacanth is a deep sea dwelling fish that was believed to be extinct 66 million years ago, around the same time the dinosaurs went extinct. However, in 1938 a specimen of the fish was discovered near the shores of South Africa. Scientists also believe that this fish may be the member of species of fish that crawled onto land to evolve into animals with legs. Upon investigation of the specimen by marine biologists certain features of the fish was discovered.

Some of them are listed below:
(i) It has paired lobe-shaped fins that move in an alternating pattern similar to the limbs of a four-legged animal. (ii) It has a lung in its body but carries out exchange of gases through gills.



Q: 12 **The lobed fin of the fish and limbs of a terrestrial animal have similar structure but different function. What are such organs called?** **[1]**

Q: 13 **A vestigial organ is an organ that is carried forward to progeny by evolution but serves no specific purpose in the body of the individual. What organ in the fish can be called a vestigial organ?** **[1]**

Q: 14 **How can scientists so accurately determine the apparent time of extinction of the fish?** **[1]**

Q: 15 **Plants that reproduce through asexual reproduction give rise to similar and not identical offsprings.** **[1]**

What could be the most likely reason for the above statement to be true?

Pea plants can have green or yellow seeds. One of the phenotypes shows dominance over the other. A farmer decides to pollinate a flower of a plant with green seeds using pollen from a flower of a plant with yellow seeds. The resulting pod has all green seeds.

Q: 16 **What should be the genotype of the parent plants to give green and yellow seeds in equal proportions?** **[1]**

Q: 17 **The farmer crosses two heterozygous green seeded plants and obtains 100 plants in the F1 generation.** **[1]**

What would be the number of green and yellow seeds respectively in the F1 generation?

Q: 18 **Sex determination in humans happens through sex chromosomes. Along with other parameters, such processes often help in forensic studies in crime investigation and / or identification of accidents and natural calamities,**
In order to determine whether an accident victim is male or female, which cells can be used and why? **[2]**

Before the Industrial Revolution, the black peppered moth was rare. During the early decades of the Industrial Revolution in England, the countryside between London and Manchester became blanketed with soot from the new coal-burning factories. Many of the light-bodied lichens died from sulphur dioxide emissions, and the trees became darkened.
This led to an increase in bird predation for light-coloured moths, as they no longer blended in as well in their polluted ecosystem.

(Source: Wikipedia:- https://en.wikipedia.org/wiki/Peppered_moth_evolution)

Q: 19 **What would have happened to the population of light-coloured moth over time and why?** **[1]**

Q: 20 **What could be an external factor that determines the return of the light-coloured moths?** **[1]**

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	3
2	2
3	1
4	4
5	4
6	1

Q.No	Teacher should award marks if students have done the following:	Marks
7	(a) 0.5 marks for each: - P: homologous - Q: analogous	1
	(a) 1 mark for each point: - Homologous organs have the same anatomy/structure but different functions. - Analogous organs have the same function but are different in anatomy.	2
8	(a) organs in different animals having similar structure and origin but different function	1
	(b) team P	0.5
	(c) Wings of insects and wings of birds are analogous organs.	0.5
	(d) 0.5 marks each for any two correct answers such as: - changes in DNA - geographical distribution of species - fossil records	1
9	(a) sex chromosomes	1
	(b) Temperature of the fertilised egg determines sex of the embryo in some reptiles.	1
	(c) The law of segregation states that a diploid organism passes a randomly selected allele for a trait to its offspring, such that the offspring receives one allele from each parent. [1 mark] - If sex determination in plants is governed by genetic factors, the offspring will get one copy of a gene from each parent. - Sex determination violates the law of segregation as the human female does not have any copy of the Y-chromosomal genes. [0.5 marks for each correct point]	2

<table>
<tr><th>Q.No</th><th>Teacher should award marks if students have done the following:</th><th>Marks</th></tr>
<tr><td></td><td>(d) 0.5 marks for each correct answer:

- the father
- because the father can pass either X or Y chromosome to the offspring</td><td>1</td></tr>
<tr><td rowspan="2">10</td><td>(a) (i) 0.5 marks for indicating the genotypes for each of the pairs correctly:
- Tt X Tt
- Tt X tt
- tt X tt

(a) (ii) 0.5 marks for indicating the correct phenotypes for each of the genotypes:
- Tt (tall) X Tt (tall)
- Tt (tall) X tt (dwarf)
- tt(dwarf) X tt (dwarf)</td><td>3</td></tr>
<tr><td>(b) (i) 0.25 marks for writing the four gametes correctly

(b) (ii) 0.25 marks for writing the four genotypes correctly

An example is shown below:

<table><tr><td></td><td>T</td><td>t</td></tr><tr><td>T</td><td>TT</td><td>Tt</td></tr><tr><td>t</td><td>Tt</td><td>tt</td></tr></table></td><td>2</td></tr>
<tr><td>11</td><td>Zero</td><td>1</td></tr>
<tr><td>12</td><td>(a) homologous organs</td><td>1</td></tr>
<tr><td>13</td><td>the lung</td><td>1</td></tr>
<tr><td>14</td><td>any one answer from:

- by studying the depth of the fossils in the rocks they were found in
- by radioactive isotope dating</td><td>1</td></tr>
</table>

Q.No	Teacher should award marks if students have done the following:	Marks
15	inaccuracies in copying of DNA from parent to offspring / mutations	1
16	0.5 marks each for both parents' genotype: 1st parent - Gg 2nd parent - gg	1
17	0.5 marks each for numbers mentioned: green seeds : 75 yellow seeds : 25	1
18	1 mark for each correct answer: - any cell of the body - every cell has the sex chromosomes as the 23rd pair	2
19	0.5 marks for each correct answer: -Their numbers would have reduced drastically. - Predation by birds due to increased visibility of the moths.	1
20	removal of soot cover from the trees	1

Chapter - 10
Light - Reflection and Refraction

Q: 1 **Two convex lenses P and Q have focal length 0.50 m and 0.40 m respectively.**

Which of the following is TRUE about the combined power of the two lenses?

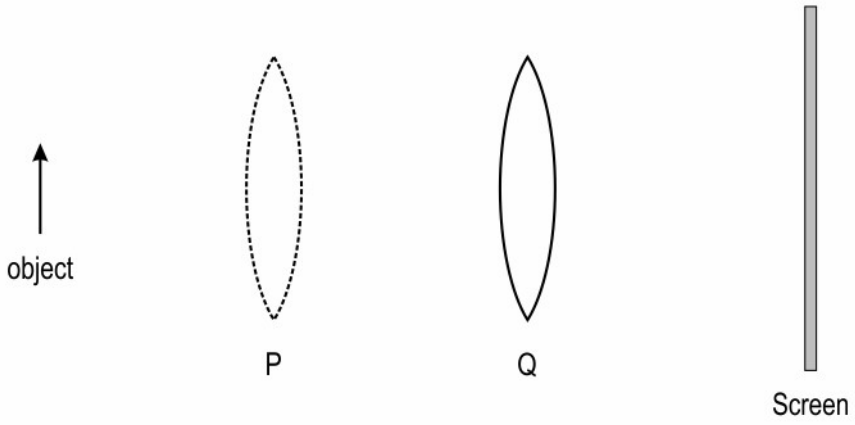
1 P is equal to 4.5 D.
2 P is less than 4.5 D.
3 P is more than 4.5 D.
4 P cannot be determined from the information given.

Q: 2 **When an incident ray of light enters a medium from air, it bends towards the normal.**

Which of the following is TRUE about the refractive index of the medium (n_m) as compared to the refractive index of air (n_a)?

1 n_m is equal to n_a.
2 n_m is less than n_a.
3 n_m is more than n_a.
4 (The refractive indices cannot be compared based on the given information.)

Q: 3 **When a lens in placed at Q, a sharp image is formed on the screen. The image formed is real, inverted and diminished. When the lens is moved to P, another sharp image is formed on the screen.**



What is the nature of the image formed when the lens is at P?

1 magnified and inverted
2 magnified and upright
3 diminished and upright
4 diminished and inverted

The image below shows a student demonstrating that sunrays concentrated to a point using a spherical mirror can burn a paper as a science project.

Answer the following questions.

Q: 4 **What is the term used for the distance between the mirror and the paper?**

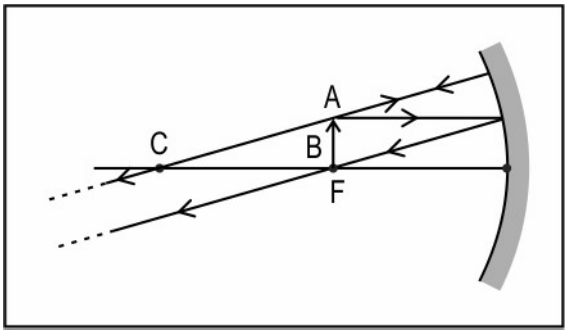
1 radius of curvature
2 principal focus
3 principal axis
4 focal length

Q: 5 **What kind of image would be formed on the paper?**

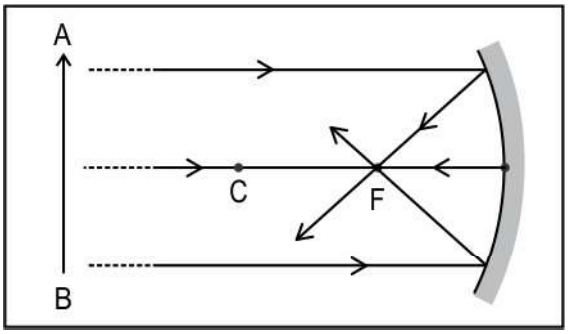
1 real and diminished
2 real and enlarged
3 virtual and diminished
4 virtual and enlarged

Q: 6 **The student wants to depict the above experiment as a ray diagram. Which of the following diagram should he draw?**

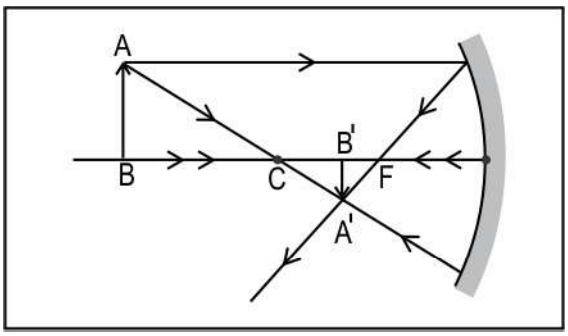
1



2



3



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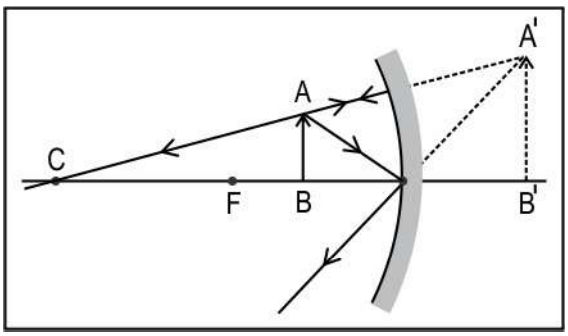


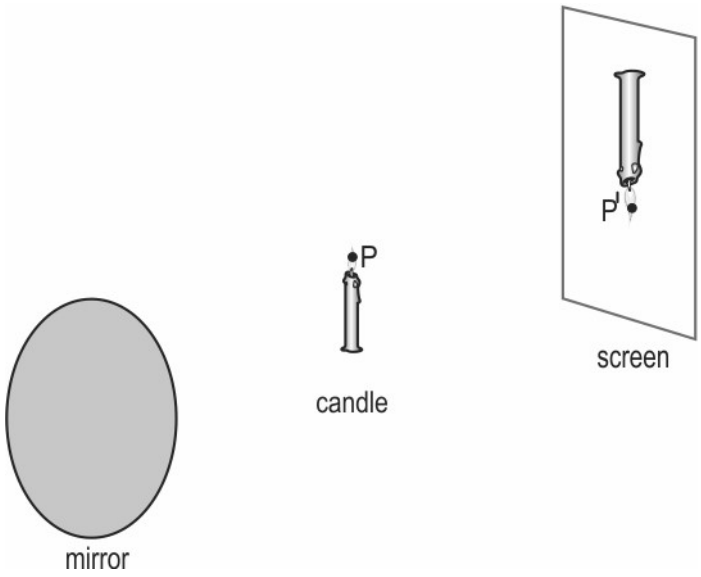
Q: 7 **If the student wishes to point the mirror to another object so as to obtain a virtual enlarged image, where should be the position of the object with respect to the mirror?**

1. at principal focus
2. at centre of curvature
3. between pole and principal focus
4. between centre of curvature and principal focus

Q: 8 **Which of the following is NOT a common use for the type of spherical mirror used by the student for the experiment above?**

1. car headlights
2. solar cooker
3. rear-view mirror
4. shaving mirrors

Q: 9 **The diagram below shows the image of a candle, as formed through reflection from a concave mirror, obtained on a screen.** **[1]**



How many light rays from the point P on the candle flame can be drawn to the corresponding point on the image P'?

Q: 10 **The eyeball of a person has become slightly larger. Which kind of lens should the person wear to correct the defect in the vision caused by this change in the size of the eyeball?** **[1]**

Q: 11 **The images formed by an ordinary convex lens suffer from a defect, called chromatic defect, which leads to false coloured edges in the images. This happens because light rays of different colours bend differently as they enter and leave the lens.** **[2]**

If a parallel white light beam passes through a convex lens, the light of which colour (among violet to red in the spectrum) will converge at a point closest to the lens? Justify your answer.

Q: 12 **Smriti is looking at herself in a convex mirror in a science museum, standing 2 m away from the mirror. Her image appears to be around half her actual height. Estimate the focal length of the mirror.** **[3]**

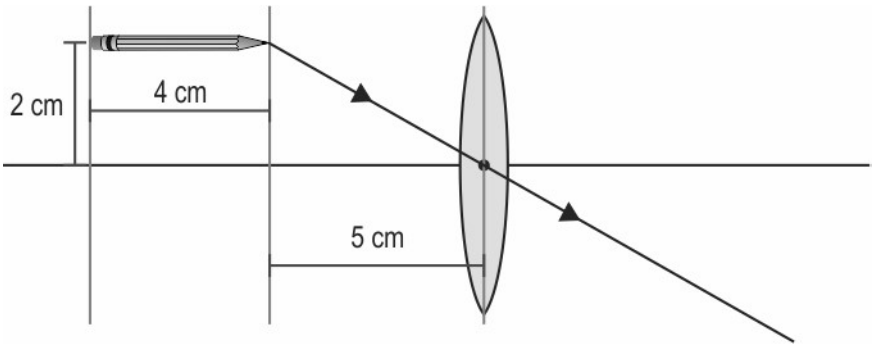
Q: 13 **In a human eye, the distance between the lens and the retina is 17 mm. The light entering the eye gets refracted at the cornea and then at the lens. Ciliary muscles in the eye can control the focal length of the lens by changing its shape.** **[3]**

(a) Diana is looking at the Moon. What is the focal length of the combination of cornea and the lens in Diana's eyes at this time?

(b) Diana is reading a book kept at a distance of 20 cm from her eyes. What is the focal length of the combination of the cornea and the lens in Diana's eyes at this time?

(c) When Diana brings the book closer to her eyes, the letters appear blurry to her and she cannot read the book. Explain why the letters appear blurry to her.

Q: 14 **(a) Copy the scaled ray diagram given below. Draw more required incident rays from the pencil to illustrate the formation of the image of the pencil by the convex lens of focal length 3 cm.** **[5]**

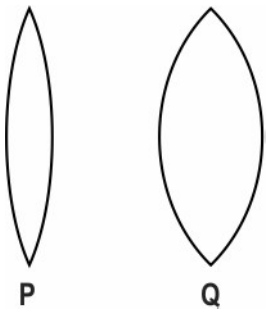


Your completed diagram should show the image of the whole pencil.
(Note: Assume that the lens in the diagram is a thin lens.)

(b) What is the distance of the image of the pointed end of the pencil from the lens?

(c) What is the length of the image of the pencil?

Q: 15 **Manju has two convex lenses P and Q made of the same material as shown in the figure.** **[3]**



She is looking at printed text on a page using lens P. She notices that when she slowly takes the lens away from the page, the text turns upside down when the lens crosses a distance of 10 cm from the page.

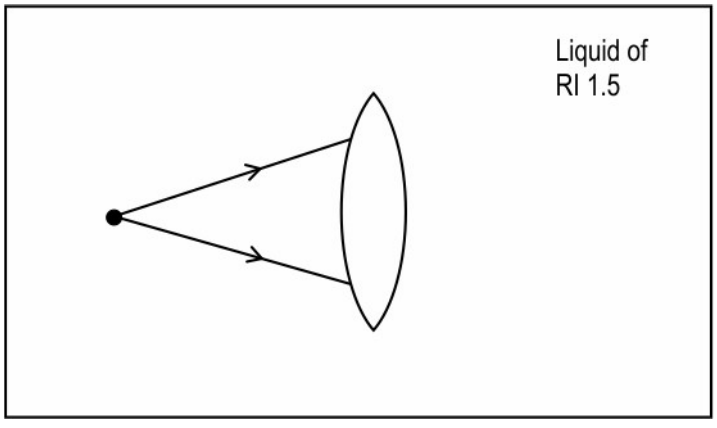
(a) Which characteristic of lens P does the distance 10 cm signify?
(b) If Manju does the same with lens Q, at what distance will the inversion of the image happen - less than, equal to, or more than 10 cm? Justify your answer.

Q: 16 **A person needs a lens of power -5.0 D for correction of his vision.** **[2]**

(a) What is the possible vision defect of the person?
(b) What is the focal length of the corrective lens?

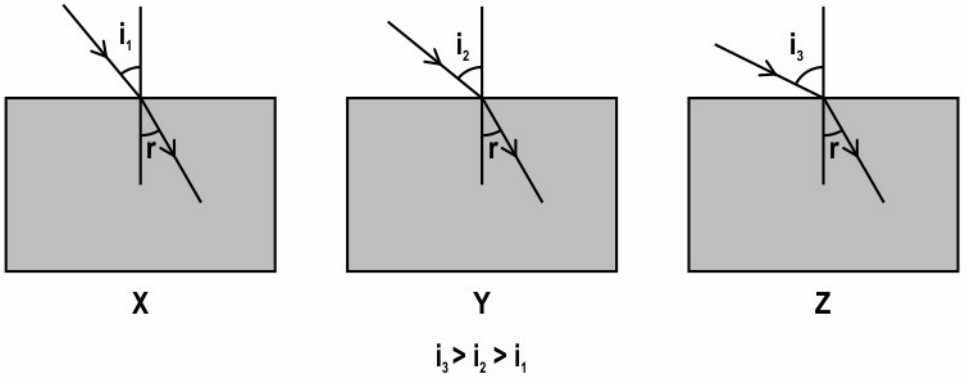
Q: 17 **A lens made of material with refractive index 1.5 is immersed in a liquid with refractive index 1.5.** **[2]**

The diagram below shows two rays incident on the lens when it is immersed in the liquid.



Copy the diagram and draw the light rays after they pass through the lens. Justify your diagram.

Q: 18 **The image below shows the refraction of light in three transparent rectangular blocks, X, Y and Z, made of different materials when they are placed in air. The angle of incidence is different in each case but the angle of refraction is the same in all three blocks.** **[2]**



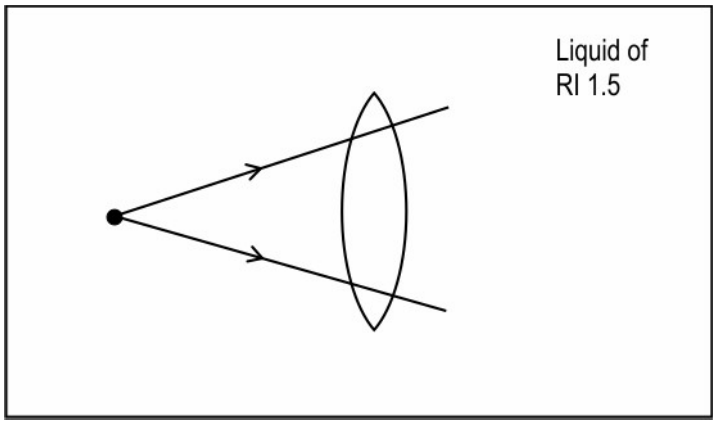
$i_3 > i_2 > i_1$

Compare the speed of light in the three blocks. Justify your answer.

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	1
2	3
3	1
4	4
5	1
6	2
7	3
8	3

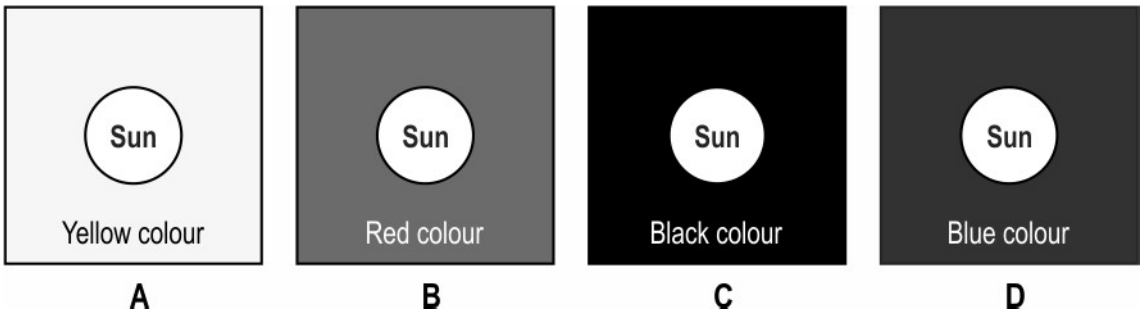
Q.No	Teacher should award marks if students have done the following:	Marks
9	infinitely many	1
10	concave lens	1
11	violet	1
	because it will bend the most after refraction OR because glass has the highest refractive index for violet coloured light	1
12	Identifying object distance as -2 m	0.5
	Finding out image distance as +1 m using magnification formula	1
	Using the correct formula (1/u + 1/v = 1/f) [0.5 marks] Calculating focal length as +2 m, using the formula [1 marks]	1.5
13	(a) 17 mm	0.5
	(b) - Substituting correct values into lens formula [0.5 marks] - Calculating focal length as 18.6 mm using lens formula [1 mark]	1.5
	(c) because the location of the image moves behind the retina	1
14	(a) Correct completed ray diagram should include the following: - another correctly drawn incident ray from the pointed end of the pencil [1 mark] - two correctly drawn incident rays from the blunt/rear end of the pencil [2 marks] - correctly drawn image of the pencil using the point images of the front and rear ends of the pencil [1 mark]	4
	(b) 7.5 cm (with an error margin of 0.5 cm)	0.5
	(c) 3.6 cm (with an error margin of 0.4 cm)	0.5
15	(a) focal length OR half the radius of curvature	1

Q.No	Teacher should award marks if students have done the following:	Marks
	(b) 1 mark for each point: **- The inversion will happen at a distance less than 10 cm.** **- A thicker lens has a smaller focal length.**	**2**
16	**(a) myopia**	**1**
	(b) 0.5 marks each for correct value and unit: **-0.2 m**	**1**
17	 **(Students should draw the rays through the lens and further in the liquid in the same direction as the incident ray without showing any bending at the interface of the liquid and the lens.)**	**1**
	Since the refractive index of the liquid is equal to that of the material of the lens, the light rays do not undergo refraction as they pass from the liquid to the lens and back into the liquid.	**1**
18	**speed in X > speed in Y > speed in Z**	**1**
	As per Snell's law, $\frac{\sin}{}$ i/sinr)} = n **Since the angle of incidence is minimum in block X, the refractive index of material of block X is minimum.** **(Award full marks even if Snell's law is not mentioned.)**	**0.5**
	The refractive index of a material is given by n = vc . **Since refractive index of block X is minimum, speed of light is maximum in block X.** **OR** **Since material of block X is the least dense, the speed of light is maximum in block X.**	

Q.No	Teacher should award marks if students have done the following:	Marks
	The refractive index of a material is given by $n = \frac{c}{v}$. Since refractive index of block X is minimum, speed of light is maximum in block X. OR Since material of block X is the least dense, the speed of light is maximum in block X.	0.5

Chapter - 11
The Human Eye and The Colourful World

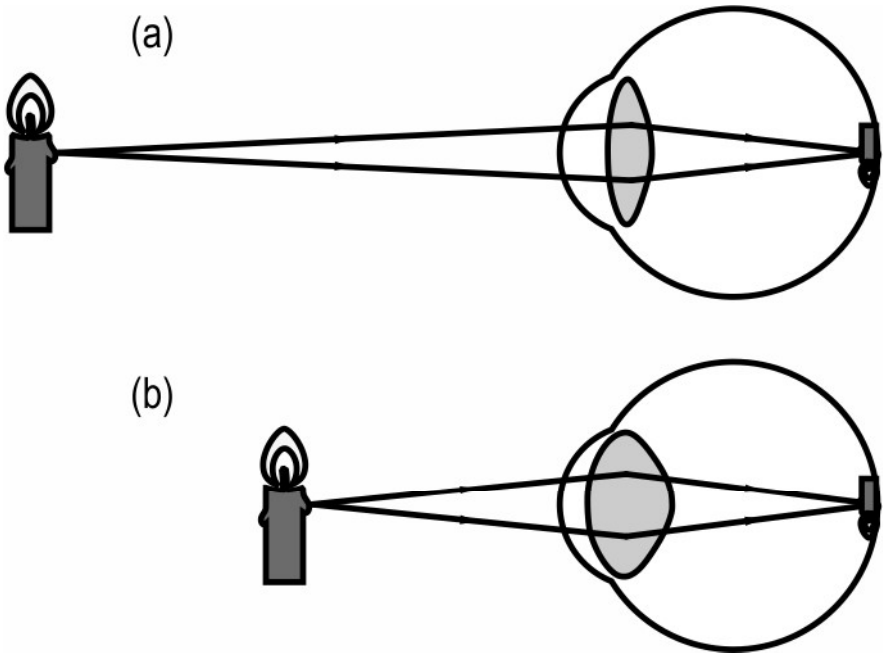
Q: 1 **If the Earth did not have an atmosphere, which of the following shows what you would see if you looked at the Sun?**



(Note: You should never look at the Sun directly.)

Answer the following questions based on the information given below:

The far point and the near point refer to the visibility of objects close by and far away from the human eye respectively. These are the maximum and minimum distances at which an object is clearly visible to a person.



Q: 2 **The near point and the far point are determined with regards to the function of which part of the eye?**

1 pupil **2** retina **3** eye-ball **4** ciliary muscles

Q: 3 **Which of these is a reason why a far-sighted person needs a convex lens to correct his vision?**

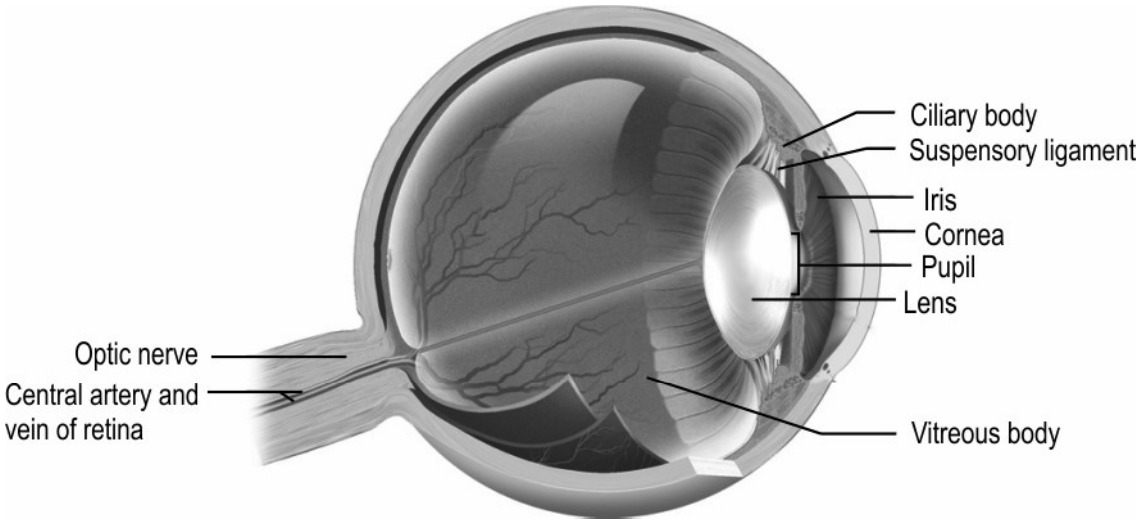
1 The image forms in front of his retina.
2 The image forms behind the retina.
3 The image forms below the retina.
4 The image forms on the retina.

Q: 4 **Under which of these can myopia and hypermetropia be classified?**

1 breakdown of tissues
2 incorrect bending of light in the eye
3 incorrect reflection of light by surfaces around us
4 incorrect coordination with brain for colour

Answer the following questions based on the given information.

The iris is a muscular diaphragm that controls the size of the pupil.
It consists of two layers: the front pigmented fibrovascular layer known as a stroma and, beneath the stroma, pigmented epithelial cells. The colour of the eye is defined by the pigmentation of the iris.



Q: 5 **Which of the following can be directly affected if the iris does not function properly?**

1 identification of colours
2 the amount of light entering the eye
3 transmission of visual information to the brain
4 finer adjustments for focussing the objects

Q: 6 **Rohan lit an incense stick in his room and after an hour observed that when a beam of sunlight entered his room through a small gap in the window, he was able to see the path of the beam.**

Which of the following is most likely TRUE about the air present in the room?

1 It is a pure substance.
2 It is a compound.
3 It is a solution.
4 It is a colloid.

Q: 7 **In a medium like glass, the velocity of light increases as the wavelength increases.**

Which of the following light would be the fastest in glass?

1 blue **2** violet **3** green **4** red

Q: 8 **Which of the following correctly gives the sequence of events that take place when human eye changes its focus from a distant object to an object closer to the eye?**

1 ciliary muscles relax - -> curvature of eye lens increases --> focal length of eye lens increases
2 ciliary muscles contract - -> curvature of eye lens decreases --> focal length of eye lens increases
3 ciliary muscles relax - -> curvature of eye lens decreases --> focal length of eye lens decreases
4 ciliary muscles contract - -> curvature of eye lens increases --> focal length of eye lens decreases

Q: 9 **A person's near point is at 45 cm and far point is at 2 m.**

What kind of corrective lens is BEST suited for his vision defect?

1 convex **2** concave **3** bifocal **4** plano-convex

Q: 10 **Nanda saw rays of sunlight entering into a dark room as shown below.** **[2]**

He then did something to the air in the room after which he was NOT able to see the rays of sunlight in the room.

What is it that Nanda could have done to make the rays of sunlight invisible? Justify your answer.

Q: 11 **Mars's atmosphere is composed mainly of carbon dioxide, nitrogen and argon and negligible amounts of oxygen, water vapour and methane.** **[1]**

Using the information given in the sentence above and knowledge about how rainbows are formed on Earth, explain why rainbow formation is impossible on Mars.

Q: 12 **Space is mostly vacuum, devoid of any medium.** **[2]**

(a) What colour does the Sun appear to the astronauts on International Space Station?
(b) Give reason for your answer to (a).

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	3
2	4
3	2
4	2
5	2
6	4
7	4
8	4
9	3

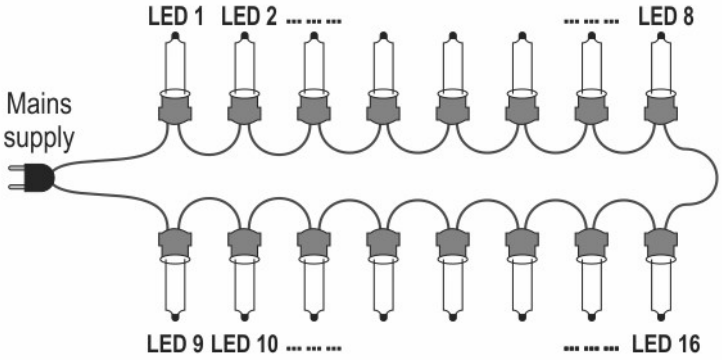
Q.No	Teacher should award marks if students have done the following:	Marks
10	Removing all the dust particles from the air in the room by passing the air through a very efficient filter.	1
	Filtering the air removes the suspended dust particles thus preventing the scattering of light which make the rays visible.	1
11	There is not enough water vapour in the atmosphere to cause scattering of light.	1
12	(a) white	1
	(b) Since there is no medium to disperse or scatter the light coming from the Sun, it appears white.	1

Chapter - 12
Electricity

Read the information given below and answer four out of five following questions.

Suresh bought a packet of 100 LEDs to make his own lights for decoration in his house. The packet on the LEDs had the following printed on a label:
LED 2835, 0.2 W, 30 Lumens, 3 V

To understand how he should connect the LEDs, he referred to the following circuit diagram on a website.



Q: 1 **Which of the following describes how the LEDs are connected in the circuit diagram?**

1. all in series
2. all in parallel
3. 8 each in a series combination, and the two combinations in parallel
4. 8 each in a parallel combination, and the two combinations in series

Q: 2 **If the LED marked 'LED 2' in the diagram stops working, which other LEDs will also stop working?**
(Note: When an LED stops working, current cannot flow across it.)

1. only LED 3 to LED 8
2. only LED 3 to LED 8 and LED 1
3. all the other LEDs in the circuit
4. none of the other LEDs in the circuit

Q: 3 **Suresh decided to connect all the LEDs in his lights in a series combination.**

How many LEDs will he need to connect if he is going to connect the lights to a 240 V mains supply so that the LEDs work at their power rating?

1. 16
2. 80
3. 240
4. 1200

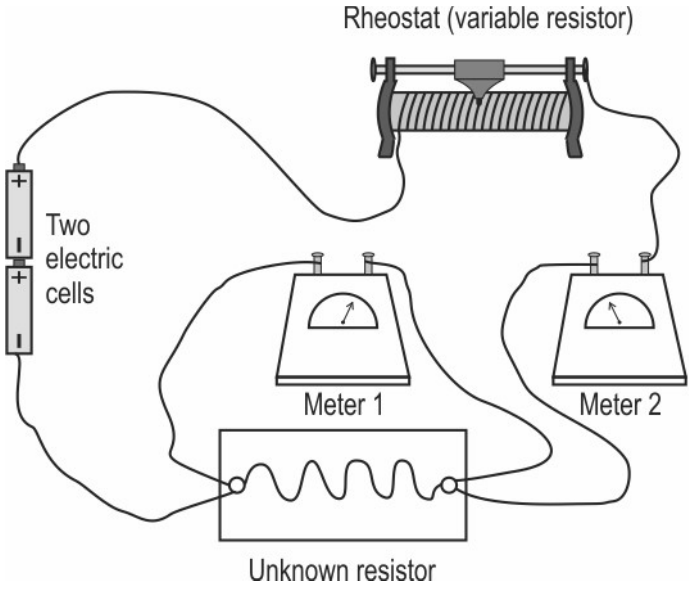
Q: 4 **What will happen if he connects 100 LEDs, all in a parallel combination, to the 240 V mains supply?**

1. Each LED will work as expected since the available voltage is more than 3 V.
2. Each LED will have a potential difference of 220 V and therefore they will get damaged.
3. Each LED will glow but the ones closer in the circuit to the main supply will glow brighter.
4. Each LED will have a potential difference of 2.4 V across it and therefore will glow dimmer than normal.

Q: 5 **How much current is each LED expected to draw when used according to the ratings given in the label?**

1 0.067 A **2** 0.600 A **3** 10 A **4** 15 A

Q: 6 **The diagram below shows how Amita had connected a circuit to verify Ohm's law.** **[5]**

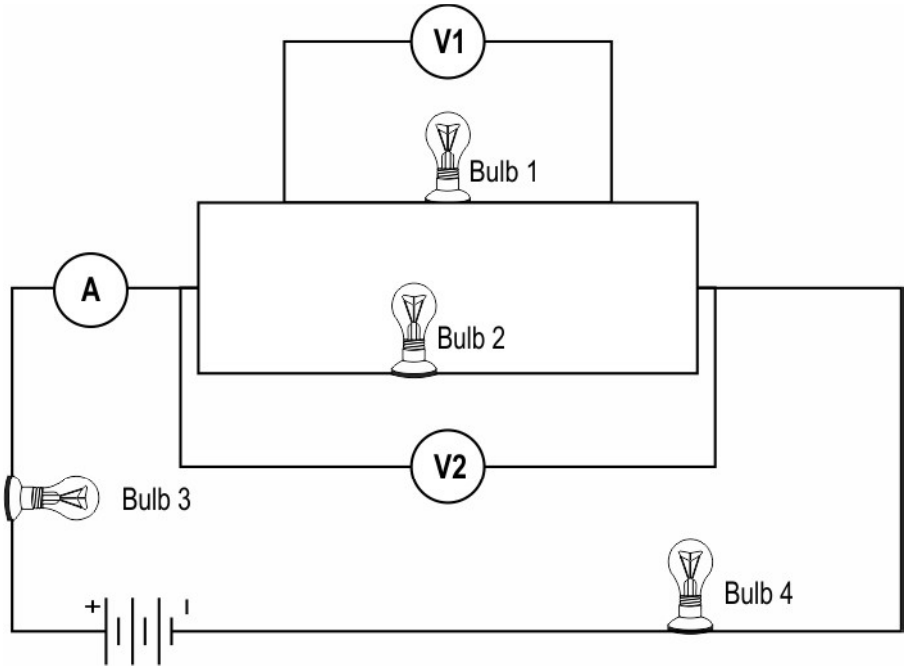


(a) Identify which of the devices in the circuit is an ammeter. Justify your answer.

(b) Draw a circuit diagram with appropriate symbols for the circuit shown in the diagram above.

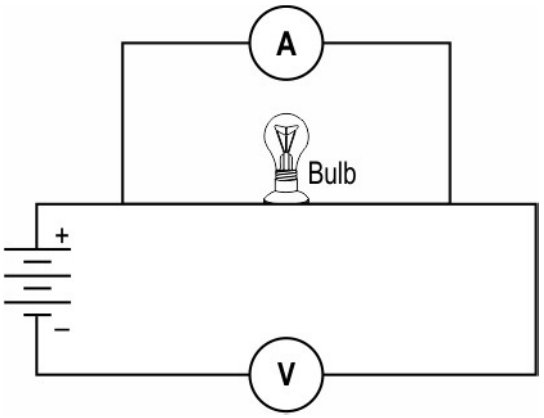
(c) Amita forgot to put a switch in the circuit. During the experiment, the wire labelled 'Unknown resistor' became hot. The resistivity of the material of the wire increases with temperature. Draw two potential difference vs current graphs (in the same diagram): (i) as expected by Amita, (ii) as based on actual observation she would make.

Q: 7 **Answer the questions based on the electric circuit shown below. All the four bulbs are identical.** **[2]**



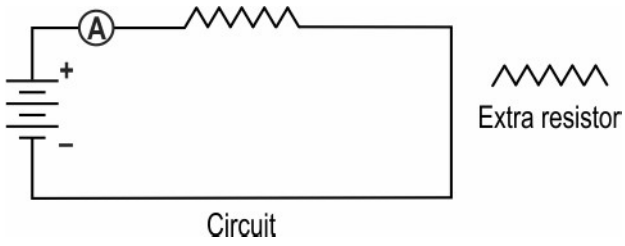
(a) How does the voltage reading on voltmeter 1 compare with the voltage reading on voltmeter 2?
(b) Identify the bulb(s) through which a current equal to the reading on the ammeter flows.

Q: 8 **Suresh arranges the electric circuit shown below to measure the current flowing through and the potential difference of a bulb.** **[1]**



Is the circuit correct? If not, then identify the mistake.

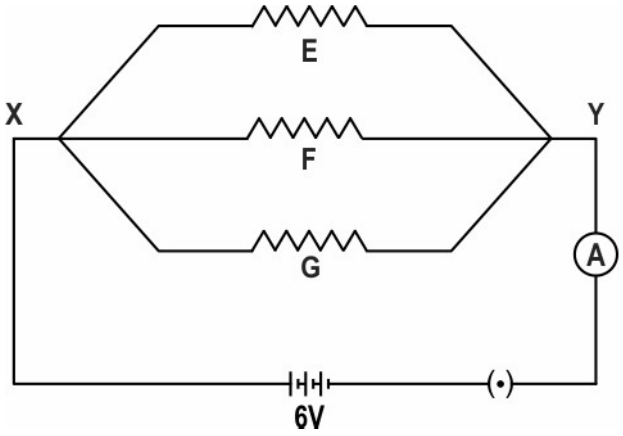
Q: 9 **Study the circuit diagram given below. You are given one extra resistor. By drawing a new circuit diagram, show how you can connect the extra resistor to increase the reading on the ammeter in the circuit below.** **[1]**



Q: 10 **Priya has a copper wire and an aluminium wire of the same length.** **[2]**

Can the electrical resistance of the two wires be the same? Justify your answer.

Q: 11 **Three resistors in a circuit are attached as shown here. The resistance of F and G are 10 ohm and 5 ohm respectively. The resistance of E is unknown. These resistors are connected to a battery with potential difference 6 V.** **[5]**

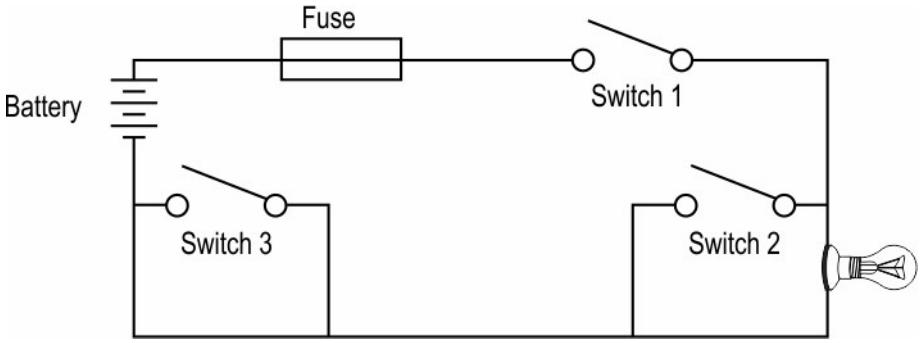


(a) What is the term used to describe such an arrangement of resistors?
(b) What is the resistance of E if 0.3 A current flows through it?
(c) What is the total current flowing in the circuit?

Q: 12 **You are given three identical 10 ohm resistors and a 12 V cell.** **[2]**

Draw the circuit diagram to show how the resistors can be connected with the 12 V cell so that the total heat produced in the circuit is the MINIMUM.

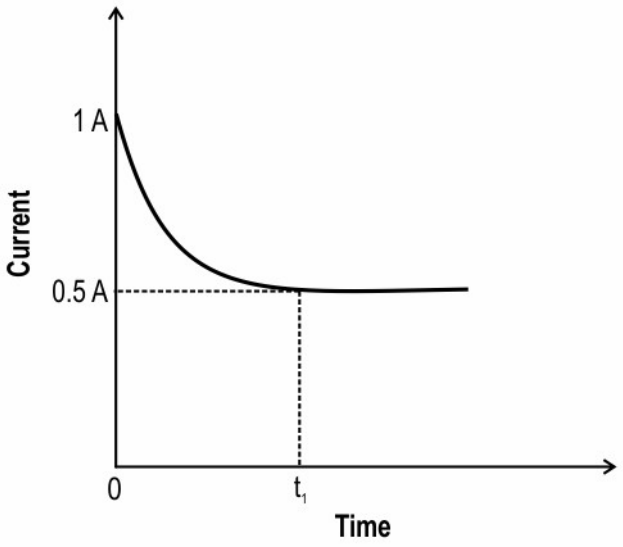
Q: 13 **Observe the circuit shown below. All the three switches are open.** **[1]**



Identify the switch/switches that on being closed will cause the fuse to blow.

Q: 14 **An incandescent bulb works on the heating effect of electric current. When a current passes through the filament of a bulb it heats the filament to a high temperature which causes the filament to glow.** **[2]**

The graph below shows the variation in the current through a bulb immediately after it is switched on. The current decreases from 1 A at time t=0 to 0.5 A at $t=t_1$. The voltage of the power supply is 200 V and remains constant throughout.

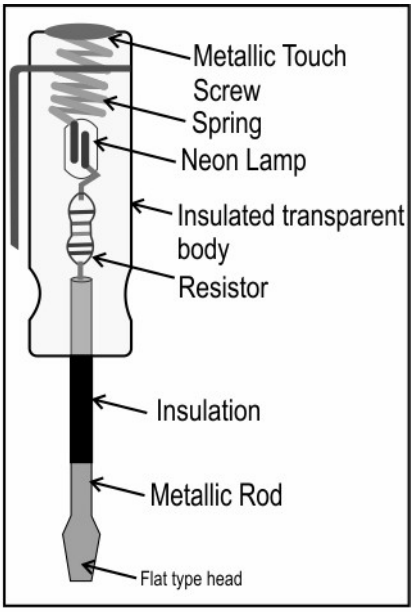


(a) Based on the graph, state how the resistance of the bulb filament changes as the temperature increases from time t=0 to $t=t_1$.

(b) What is the power consumed by the bulb when it is glowing at its full brightness?

Q: 15 **The picture P below shows an electrical tester being used to check the electric point. The picture Q is a diagram showing the internal parts of the electrical tester.** **[2]**

P

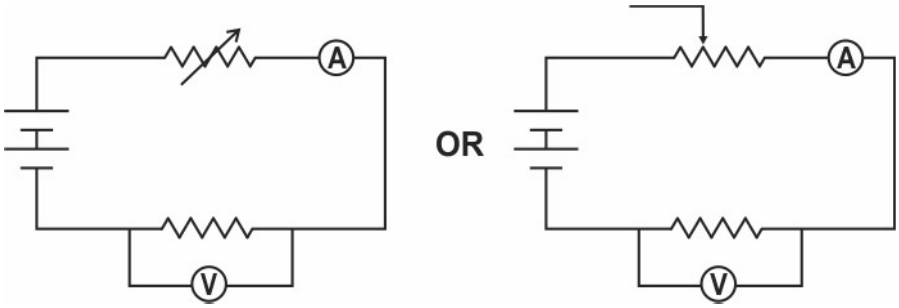
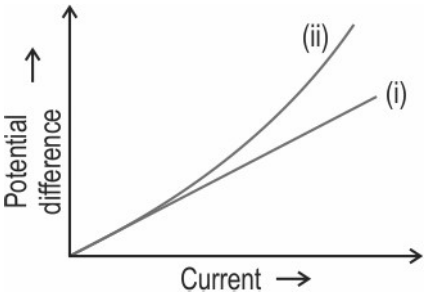


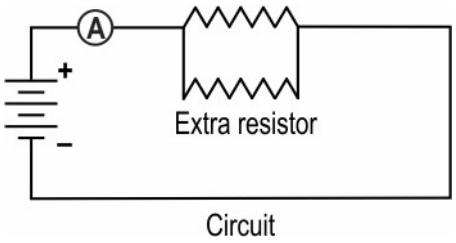
Q

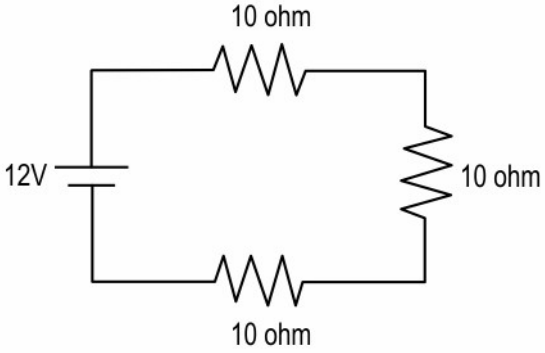
(a) Give the most likely explanation why an electrician does not get an electric shock when he touches the metallic touch screw and the lamp of the tester glows.
(b) Which part of the tester prevents the shock when the metallic touch screw is touched?

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	1
2	3
3	2
4	2
5	1

Q.No	Teacher should award marks if students have done the following:	Marks
6	**(a)** **- Meter 2 [0.5 marks]** **- because it is connected in series with the unknown resistor through which the current needs to be measured [0.5 marks]**	**1**
	(b) **- Correct connections for the cell, the unknown resistor and the rheostat in the diagram [0.5 marks]** **- Correct connections for the two meters in the diagram [0.5 marks]** **- Use of correct symbols for all components [1 mark]** 	**2**
	(c) **(i) straight line passing through origin [1 mark]** **(ii) curved line with an increasing slope [1 mark]** 	**2**
7	**(a) The voltage reading on voltmeter 1 will be the same as the reading on voltmeter 2.**	**1**
	(b) 0.5 marks each for the following: **- bulb 3** **- bulb 4** **(No marks to be awarded if Bulb 1 and/or 2 is included in the answer.)**	**1**

Q.No	Teacher should award marks if students have done the following:	Marks
8	**0.5 marks for each of the following:** **- The circuit is incorrect.** **- The positions of the ammeter and voltmeter have been interchanged.**	1
9	 Circuit	1
10	**Yes, the electrical resistance of the two wires can be the same.** **(No marks to be awarded if justification is not written.)**	1
	if the area of cross-section of the two wires is different **OR** **if the thickness of the two wires is different**	1
11	**(a) Resistors are attached in parallel**	1
	(b) Resistance of E= R_1 **I=V/R** **0.3 = 6/R** **R_1 = 6/0.3** **R_1 = 20 ohm** **[1.5 marks for the steps to calculate R_1 and 0.5 marks for final answer]**	2
	(c) Total current (I)= $V/R_1 + V/R_2 + V/R_3$ **= 6/20+6/10+6/5** **= 0.3+0.6+1.2** **= 2.1 A** **[1.5 marks for the steps to calculate R_1 and 0.5 marks for final answer]**	2

Q.No	Teacher should award marks if students have done the following:	Marks
12		1
13	1 mark for identifying both, Switch 1 and Switch 2	1
14	(a) The resistance of the bulb increases as the temperature increases.	1
	(b) The current when the bulb is glowing at its full brightness = 0.5 A Power = V × I = 200 × 0.5 = 100 W	1
15	(a) A very low current flows through the tester.	1
	(b) the resistor	1

Chapter - 13
Magnetic Effects of Electric Current

Q: 1 **Two statements are given below - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements A and R.**

Assertion (A): In an AC electric generator, a current is induced in the coil as the coil rotates between the poles of a permanent magnet.

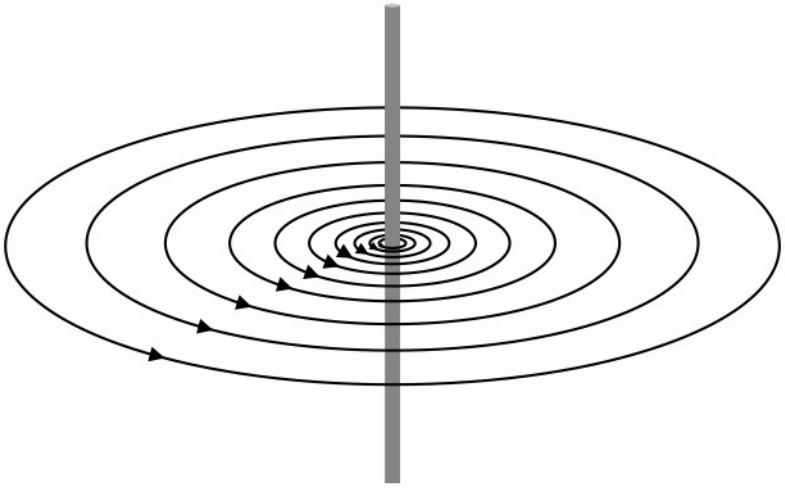
Reason (R): The force due to the magnetic field makes the coil rotate in an AC electric generator.

Which of the following is correct?

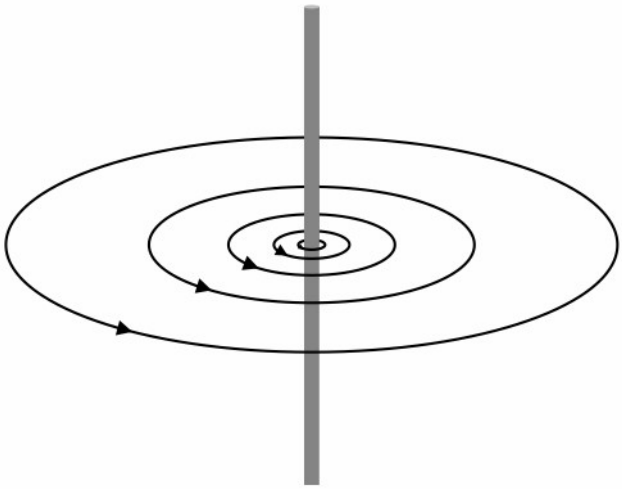
1 Both A and R are true, and R is the correct explanation of A.
2 Both A and R are true, but R is not the correct explanation of A.

3 A is true, but R is false.
4 A is false, but R is true.

Q: 2 **The diagram below shows the magnetic field lines due to a current in a straight conductor.**



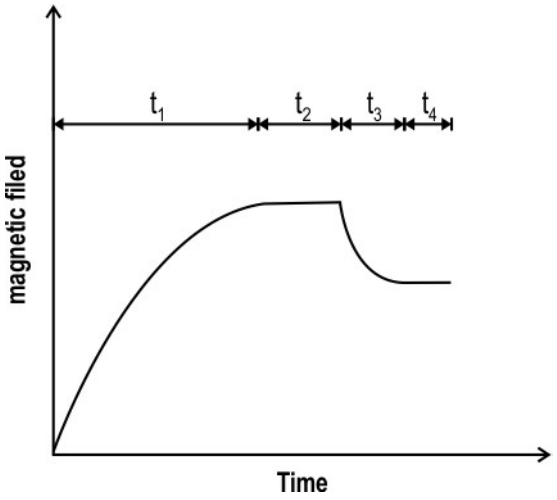
Something was done to the current because of which the magnetic field lines changed as shown below.



What was done to the current?

1 Its magnitude was increased and its direction reversed.
2 Its magnitude was decreased and its direction reversed.
3 Its magnitude was increased.
4 Its magnitude was decreased.

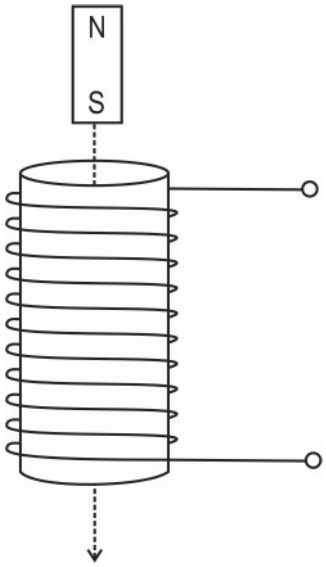
Q: 3 **A stationary metal coil is placed in a magnetic field. The strength of the magnetic field varies with time as shown in the graph below.**



In which of the time intervals(s) is a current induced in the coil?

1. only t_1
2. only t_1 and t_3
3. only t_2 and t_4
4. all - t_1 ,t_2 ,t_3 ,t_4

Q: 4 **A small bar magnet is dropped vertically from rest into a long coil of wire, and it leaves from the other end as shown in the diagram below.** **[1]**



Compare the magnitude and direction of
- the induced current in the coil when the magnet enters the coil, with
- the induced current in the coil when it leaves the coil.

Q: 5 **In a DC motor with a commutator, how many times does** **[1]**
(i) the current in the armature coil change its direction during one rotation of the coil,
(ii) the current stop flowing in the armature coil during one rotation of the coil?

Q: 6 **Arun built a DC electric motor using whatever scrap material he had. Since he did not have a split ring, he used a full ring in contact with the brushes.** **[2]**

Diagram of DC motor using a split ring

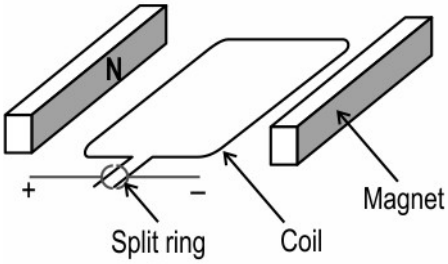
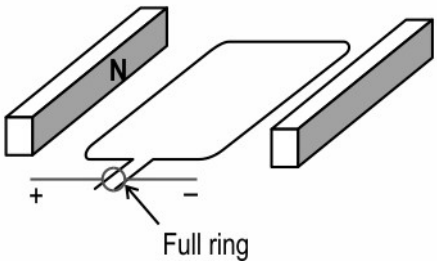


Diagram of DC motor using a full ring

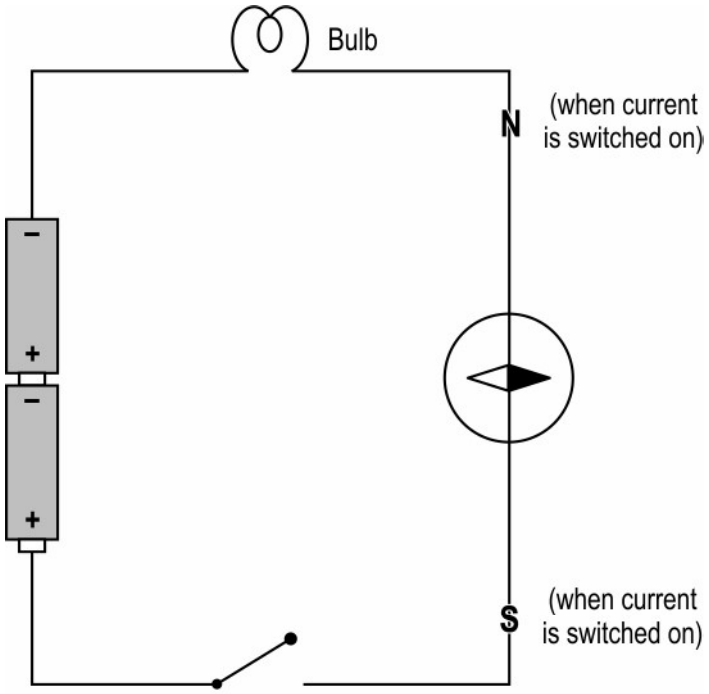


State what will be the effect of using a full ring on the movement of the axle in Arun's motor. Give a reason for your answer.

Q: 7 **In 1820, Hans Christian Oersted discovered that a magnetic needle is deflected by a current-carrying wire. For many years, he had expected to find a connection between electricity and magnetism.** **[3]**

Before his discovery, Oersted had imagined the magnetic field to be a straight line along the direction of the wire - with the north pole at one end and the south pole at the other. This was a major reason why he took so long to discover electromagnetism.

The figure below shows how Oersted would have arranged his wire and magnetic needle in his early experiments.

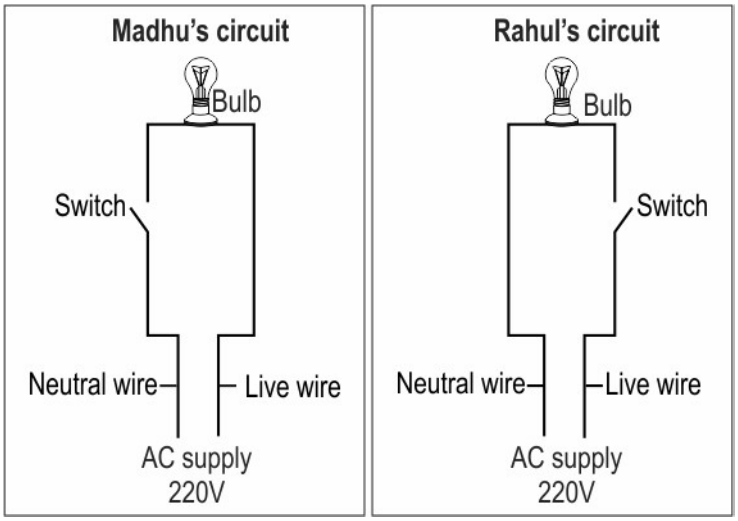


How Oersted imagined the magnetic field

(a) Draw a diagram to show the observation that Oersted would have expected when switching on the current, if his hypothesis had been correct.

(b) Based on our current knowledge of the magnetic field around a wire, explain why his experiment failed.

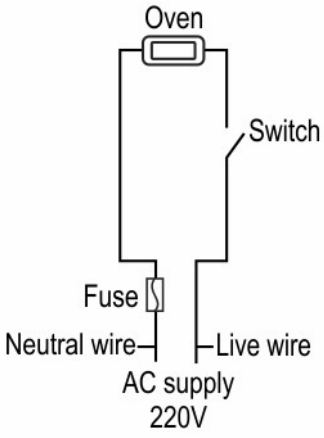
Q: 8 **Observe Madhu's and Rahul's circuits shown below.** **[3]**



(a) In which circuit will the bulb glow when the switch is closed? Explain why.

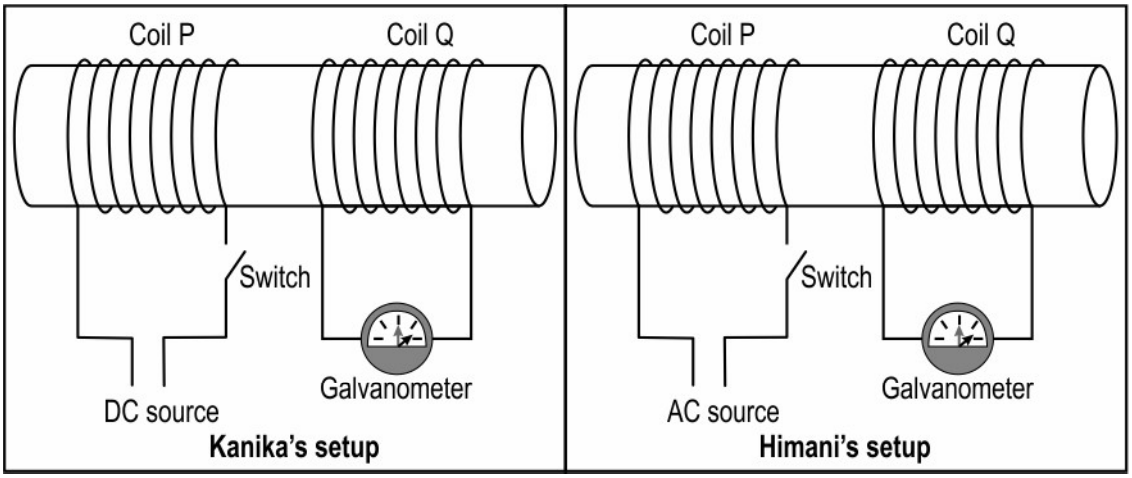
(b) Both Madhu and Rahul open the switches in their circuits to change the bulbs. For whom will changing the bulb be safe and for whom will it be dangerous? Explain why.

Q: 9 **(a) In the circuit below, in case of an overload, will the fuse protect the electric oven from damage? Justify your answer.** **[3]**



(b) If the oven has a rating of 13 A, what should be the minimum rating of the fuse?

Q: 10 **Kanika and Himani have set up two coils P and Q as shown below. The only difference between the two set-ups is the source of electricity.** **[2]**



State what will the galvanometer indicate when the switch is closed in both the set-ups.

Q: 11 **An induction cooktop works on the principle of electromagnetic induction. Inside the cooktop there is a tightly wound metal coil. An alternating current flows through the coil and produces an invisible, high-frequency, alternating magnetic field all around it.** **[3]**

When a vessel made of magnetic material is placed on the cooktop, the magnetic field produced by the coil penetrates the iron of the vessel and induces whirling electrical (eddy) currents inside the pan and makes it hot.

There is no open flame used. Heat from the pan flows directly into the food or water inside it (by conduction) without heating up the area surrounding the cooktop. Unless there is a pan on the cooktop, no heat is produced.

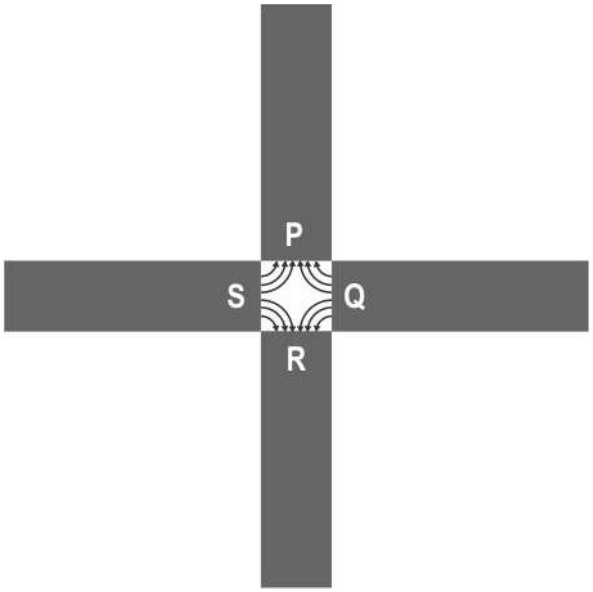
Cooking on a gas stove

Cooking on an induction cooktop

List any two advantages, with reasons, of cooking using an induction cooktop instead of a gas stove.

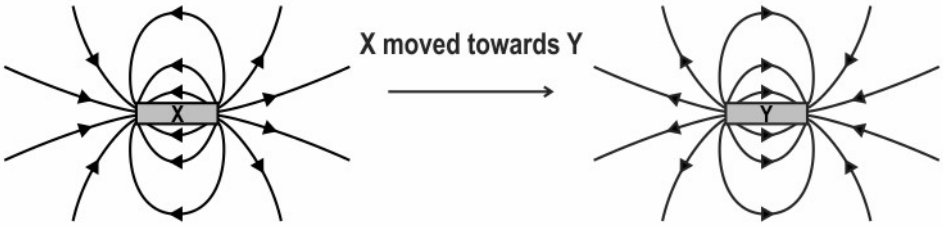
Q: 12 **Quadrupole magnets consist of groups of four magnets and are used in particle accelerators.** **[1]**

The image below shows four bar magnets configured to produce a quadrupole. The magnetic field lines between the magnets is marked.



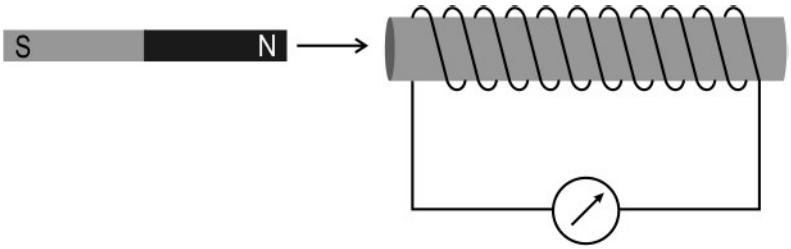
What are the poles of the magnets at P, Q, R and S?

Q: 13 **The figure shows two magnets X and Y kept near each other. Their poles are not marked, but the magnetic field lines are shown in the figure.** **[2]**



If magnet X is moved towards magnet Y as indicated by the arrow, will the two magnets attract or repel each other? Justify your answer by describing how you interpret the field lines.

Q: 14 **A coil is connected to a galvanometer as shown in the image below. The galvanometer shows a deflection to the right when the north pole of a magnet is moved towards the coil.** **[1]**



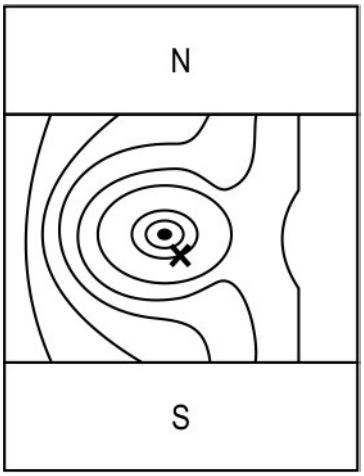
State the deflection in the galvanometer when both the coil and the magnet are moved towards the right at the same speed. Give a reason for your answer.

Q: 15 **A current clamp is an electrical device used to measure current in a conductor without making any physical contact with the conducting part of the conductor. The current clamp has jaws that clamp around the conductor as shown below.** **[2]**

Some current clamps work on the principle of electromagnetic induction and hence can measure only alternating current.

Give a reason why direct current cannot be measured by these current clamps.

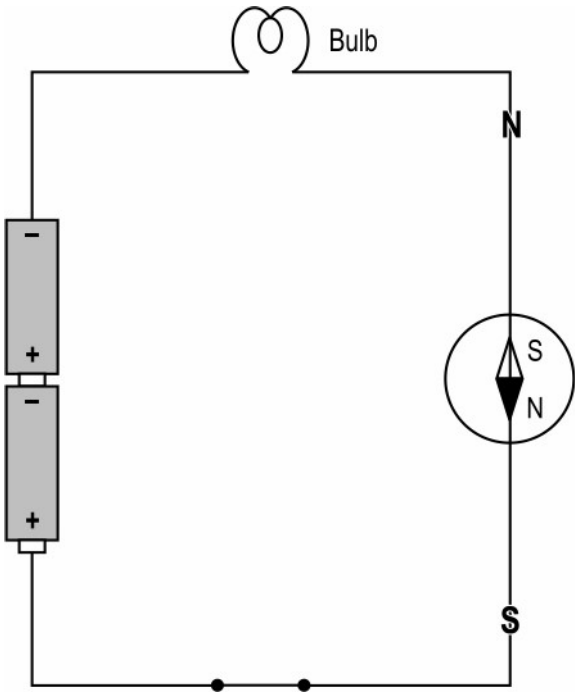
Q: 16 **The image below shows the cross-section of a wire placed between the poles of a magnet. The wire carries an electric current out of the plane of the page. Both the current carrying wire and the magnet generate a magnetic field. The resulting shape of the magnetic field is as shown.** **[3]**



(a) Draw arrows on the magnetic field lines to mark the direction of the magnetic field.
(b) In the image above, the left side of point X indicates a stronger magnetic field compared to the right side. What feature in the image indicates this?
(c) What is the direction of the force acting on the current carrying wire?
(d) Name and state the rule you used to determine the direction of force in (c).

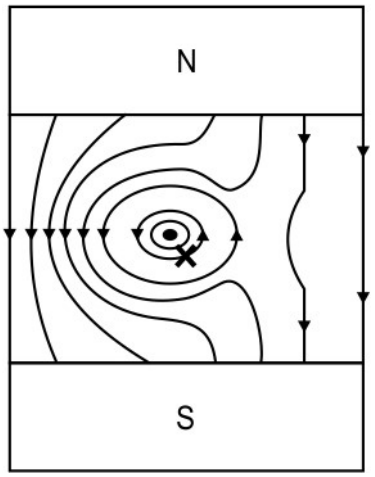
The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	3
2	4
3	2

Q.No	Teacher should award marks if students have done the following:	Marks
4	**Magnitude of the induced current will be more when the magnet leaves the coil. [0.5 marks]** **Direction of the induced current will be reversed when the magnet leaves the coil. [0.5 marks]**	**1**
5	**(i) twice [0.5 marks]** **(ii) twice [0.5 marks]**	**1**
6	**The motor will not work.**	**1**
	1 mark for any of the following: **- Electric current will not flow through the coil.** **- There would be a short circuit.**	**1**
7	**(a) 1 mark for showing the magnetic needle aligned with the wire.**  	**1**

Q.No	Teacher should award marks if students have done the following:	Marks
	(b) 1 mark for each point: **- The magnetic field due to the current is perpendicular to the wire.** **- Since the needle is already pointing in a direction perpendicular to the wire, it will not get deflected.**	**2**
8	**(a) 0.5 marks each for the following:** **- The bulb will glow in both the circuits.** **- The circuits will be closed / complete.**	**1**
	(b) 0.5 marks for each of the following: **- Changing the bulb will be dangerous for Madhu.** **- Changing the bulb will be safe for Rahul.** **- In Madhu's circuit, the bulb point is still connected to the live wire and can give an electric shock even when the switch is in the open position.** **- In Rahul's circuit, the bulb point is no longer connected to the live wire when the switch is in the open position.**	**2**
9	**(a) 1 mark for each of the following:** **- No** **- The fuse will blow only after current has passed through the oven and damaged it.**	**2**
	(b) 1 mark for any one of the following: **- a little above 13 A** **- 14 A** **- 15 A**	**1**
10	**1 mark each for the following:** **- In Kanika's set-up the galvanometer will show a deflection when the switch is closed and will then go back to zero.** **- In Himani's set-up the galvanometer will continuously show a deflection from one side to the other.**	**2**

Q.No	Teacher should award marks if students have done the following:	Marks
11	0.5 marks each for any two advantages and 1 mark for the reason such as: - Less wastage of energy as heat: Heat is produced in the vessel, so much less is lost to the surroundings. - Greater safety as less chance of fire: There is no open flame on an induction cooktop. - Less air pollution in the kitchen: As no fuel is used, no carbon dioxide is produced due to combustion of fuel. - Less danger from burns:As the cooktop does not get heated.	3
12	0.5 marks for each of the following: -P and R: south pole -Q and S: north pole	1
13	They will repel each other.	1
	The right end of magnet X and the left end of magnet Y are both north poles since field lines start from there.	1
14	The galvanometer will not show any deflection.	0.5
	Since the coil and the magnet are moved at the same speed, there is no relative motion between them and no current is induced in the coil. Therefore, there is no deflection in the galvanometer.	0.5
15	In DC, the magnitude of current is constant and hence it produces a constant magnetic field. Current can be induced only by a changing magnetic field. Since DC produces a constant magnetic field, it cannot induce current and hence the current clamp cannot measure DC. (1 mark for each statement.)	2

Q.No	Teacher should award marks if students have done the following:	Marks
16	(a)  	1
	(b) The field lines on the left side of X are crowded compared to the right side indicating a stronger field.	0.5
	(c) The wire experiences a force towards the left.	0.5
	(d) Fleming's left hand rule. According to this rule, if we stretch the thumb, the forefinger and the middle finger of the left hand such that they are mutually perpendicular to each other and the forefinger points in the direction of magnetic field and the second finger in the direction of current, then the thumb will point in the direction of motion or the force acting on the conductor. (Do not award any marks for just naming the rule and not stating it.)	1

Chapter - 14
Sources of Energy

Q: 1 **Water stored in reservoirs created by building dams across rivers is used to generate hydroelectricity which is a renewable energy source.**

Which of the following help to generate hydroelectricity?

P) gravity
Q) solar energy

1 only P **2** only Q **3** both P and Q **4** neither P nor Q

Q: 2 **Two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements A and R.**

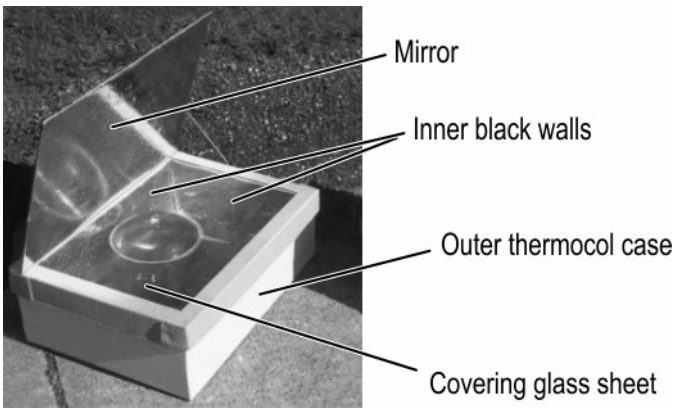
Assertion (A): Incident sunlight on a solar panel on the earth's surface is lower than the incident sunlight on the solar panels of a spacecraft.
Reason (R): Sunlight is not obstructed by a medium like air in space.

1 Both A and R are true, and R is the correct explanation for A.
2 Both A and R are true, but R is not the correct explanation for A.
3 A is true, but R is false.
4 A is false, but R is true.

Q: 3 **Biomass is the organic material of plants and animals. It can be treated and used as fuels called biofuels.** **[1]**

State one major advantage in the use of biofuels over fossil fuels.

Q: 4 **A solar cooker is a device which cooks food with the help of solar energy.** **[4]**



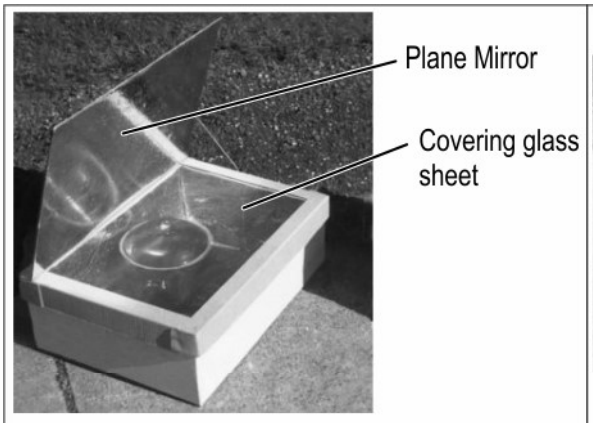
There are three main components to the functioning of most solar cookers:

- Concentration (to gather and focus energy)
- Absorption (ability to attract or hold heat)
- Retention (capacity to retain heat)

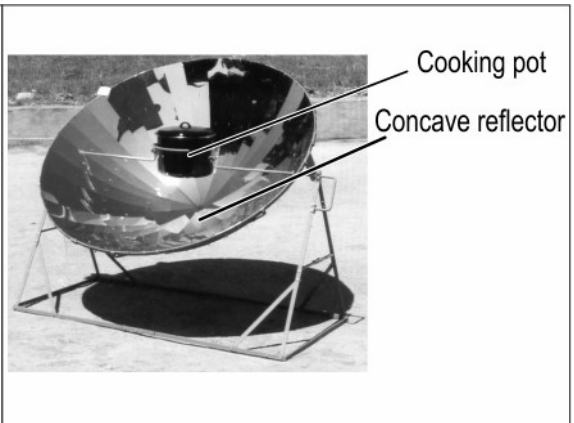
In the diagram of the solar cooker shown above, match the parts labeled with the correct function that they perform.

Part of cooker	Function
(a) mirror	
(b) inner black walls	
(c) outer thermocol case	
(d) covering glass sheet	

Two types of solar cookers are shown below.



Box type solar cooker



Parabolic solar cooker

The box type has a plane mirror to reflect sunlight and is closed with a covering glass sheet. The cooking pot is placed in the box below the glass sheet.
The parabolic type has a concave reflector that acts as a concave mirror but is open. The

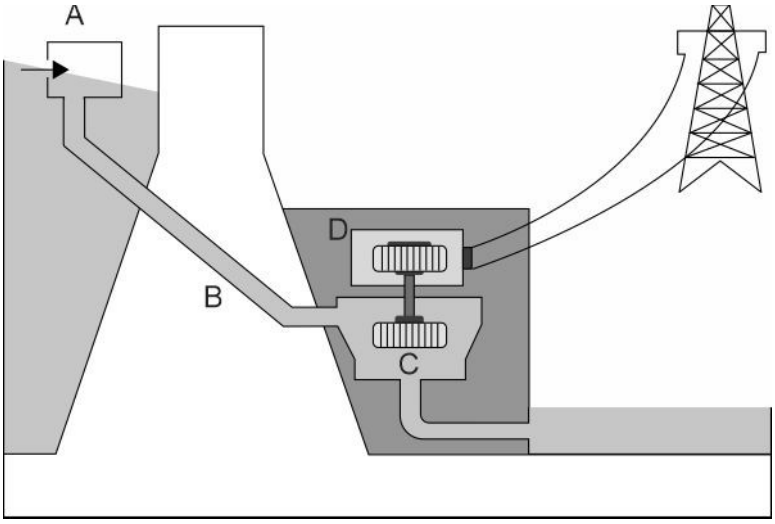
cooking pot is placed at the focal point of the concave reflector.

Answer the questions that follow based on the information given.

Q: 5 **In which of the two types of solar cookers shown above are higher temperatures likely to be obtained? Justify your answer.** **[2]**

Q: 6 **(a) State the function of the covering glass sheet in the box type solar cooker.** **[3]**
(b) What is the mode of heat transfer by which the contents of the box get heated?
(c) Name the natural phenomenon that the functioning of the covering glass sheet in a box type solar cooker is similar to.

Q: 7 **Given below is a schematic of a hydro-electric power plant.** **[2]**



Write the energy conversion that take place:

(a) Point A to B
(b) Point C to D

Q: 8 **Kazakhstan produces 41% of the world's total industry grade uranium, but has only one operational nuclear reactor for power generation.** **[2]**

Give TWO limiting factors that could be likely reasons for the above fact.

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	3
2	1

Q.No	Teacher should award marks if students have done the following:	Marks
3	Biofuels are renewable sources of energy, as trees can be grown again. OR Biofuels will cause less harm to the environment due to less mining activities. OR Any other correct answer explaining advantage of biofuel over fossil fuel.	1
4	1 mark for each part correctly matched with its function: (a) Mirror - concentration (b) Inner black walls - absorption (c) outer thermocol case - retention (d) covering glass sheet - retention	4
5	in the parabolic type	1
	The concave reflector concentrates the sunlight at the focal point.	1
6	(a) to trap heat inside the box	1
	(b) radiation	1
	(c) the green-house effect	1
7	1 mark for each correct answer: (a) potential energy to kinetic energy (b) kinetic energy to electrical energy	2
8	1 mark each for any two factors such as: - high cost of installation - high risk of radiation leak - high cost for disposal of nuclear waste	2

Chapter - 15
Our Environment

Answer the following questions based on the given information.

Hydrogen gas is an excellent fuel. It has a high calorific value and produces only water as the product of combustion. It is considered to be a potentially important, non-polluting energy source of the future.

Hydrogen is labelled with different 'colours' based on the method by which it is produced, as given below:

- green hydrogen: manufacturing process does not produce carbon dioxide
- blue hydrogen: manufacturing process produces carbon dioxide but it is separated and stored
- grey hydrogen: manufacturing process produces carbon dioxide which is released into the air

Q: 1 **Hydrogen is labelled 'brown' if the manufacturing process releases both carbon dioxide and carbon monoxide to the air.**

In what way is the manufacturing process of brown hydrogen WORSE than that of grey hydrogen for the environment?

1. It releases into the atmosphere a gas that directly causes a greenhouse effect.
2. It releases into the atmosphere carbon which was stored for millions of years.
3. It releases into the atmosphere a gas that is toxic to human beings.
4. It releases into the atmosphere gases that cause acid rain.

Q: 2 **What is the ratio of average amount of energy absorbed by producers to the average amount of energy absorbed by the primary consumers?**

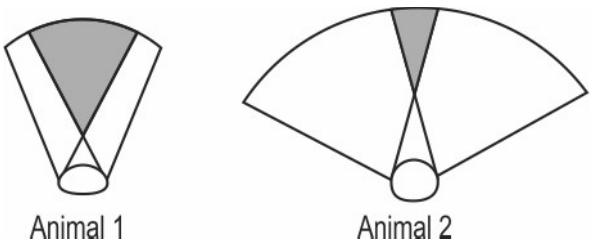
1. 1:2
2. 2:1
3. 1:10
4. 10:1

Q: 3 **Which of the following describes the flow of energy and nutrients, respectively, through the ecosystem?**

1. bidirectional and cyclic
2. unidirectional and cyclic
3. cyclic and bidirectional
4. cyclic and unidirectional

Answer the two following questions based on the information given below.

Shown here is the extent to which two different animals can see in either direction without turning their heads. In animal 1, the eyes are placed towards the front of the head and in animal 2, the eyes are placed on either side of the head.



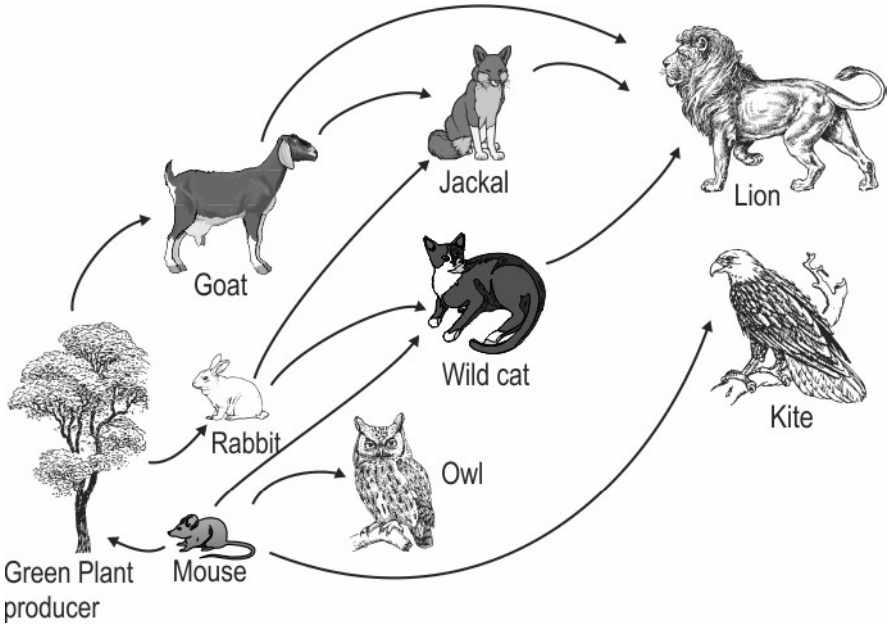
Since the placement of eyes in the two animals is different, their vision is also slightly different.

In the figures above, the grey part represents the parts that can be seen by both eyes at a time, whereas the white parts represent those parts that can be seen only by one eye at a time.

Animal 2 can see a broader area at any time compared to animal 1. Animal 1 can distinguish depths better compared to animal 2.

Q: 4 **Based on this, which of the two animals is most likely to be a predator and why?** **[2]**

Q: 5 **Observe the following food web. Classify the animals into two groups – one that would need to have vision as Animal 1 and another as Animal 2 in the diagram above.** **[1]**



Q: 6 **[1]**

bone	metal can	paper sheet	plastic bottle

Arrange the four objects given above according to the time they take to get biodegraded (LEAST time TO MOST time).

Q: 7 **Answer the following questions about transfer of materials in the ecosystem.** **[3]**

(a) Mention TWO ways by which energy is lost from the trophic levels in the ecosystem.
(b) A lot of harmful chemicals enter our body through different sources like food. Since human beings are at the top of the food chain/ trophic structure, maximum concentration of such chemicals is found in human beings. What is this phenomenon known as?

Q: 8 **The stratosphere is very dry and rarely allows clouds to form. In the extreme cold of the polar winter, however, stratospheric clouds of different types may form. These clouds are called Polar Stratospheric Clouds (PSCs).** **[5]**

Scientists recently discovered that polar stratospheric clouds, long known to play an important role in Antarctic ozone destruction, are occurring with increasing frequency in the Arctic. These high-altitude clouds form only at very low temperatures help destroy ozone in two ways: (1) They provide a surface which converts benign forms of chlorine into reactive, ozone-destroying forms, and (2) they remove nitrogen compounds that moderate the destructive impact of chlorine. In recent years, the atmosphere above the Arctic has been colder than usual, and polar stratospheric clouds have lasted into the spring. As a result, ozone levels have been decreasing.

(Information credit: NASA)

(a) How is ozone formed in the outer atmosphere?
(b) Ozone is being continuously destroyed due to extreme low temperatures. However, ozone formation is also a continuous process. Why is there a depletion in the ozone layer still?
(c) What can be a positive effect of global warming on the depletion of the ozone layer?
(d) How does ozone layer depletion impact human health?

Q: 9 **Lions have no known natural predators.** **[1]**

Based on energy transfer in a food chain, what could be the most likely reason for the above statement?

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	3
2	4
3	2

Q.No	Teacher should award marks if students have done the following:	Marks
4	Animal identified correctly as Animal 1.	1
	Reason shared correctly: Animal 1, because it will be able to judge the distance and the movement of the prey accurately.	1
5	Animal 1: lion, jackal, kite, wild cat and owl Animal 2: mouse, goat, rabbit	1
6	paper sheet, bone, metal can, plastic bottle	1
7	(a) 1 mark for each correct answer such as: - as heat - in maintaining life processes - utilised in growth and storage	2
	(b) biological magnification or biomagnification	1
8	(a) 1 mark for each correct step of the process: - The higher energy UV radiations in the higher levels of atmosphere split apart some molecular oxygen (O_2) into free oxygen (O) atoms. - These atoms then combine with the molecular oxygen to form ozone.	2
	(b) because the rate of destruction is higher than the rate of formation	1
	(c) Rise in polar temperature might restrict the formation of PSCs and reduce the depletion of the ozone layer.	1
	(d) Removal of ozone layer allows harmful UV radiations to enter and cause diseases like skin cancer.	1
9	Lions generally occur at the tertiary or quaternary levels in a food chain and energy available after that trophic level is not sufficient for sustenance.	1

Chapter - 16
Sustainable Management of Natural Resources

Answer the following questions based on the given information.

Hydrogen gas is an excellent fuel. It has a high calorific value and produces only water as the product of combustion. It is considered to be a potentially important, non-polluting energy source of the future.

Hydrogen is labelled with different 'colours' based on the method by which it is produced, as given below:

- green hydrogen: manufacturing process does not produce carbon dioxide
- blue hydrogen: manufacturing process produces carbon dioxide but it is separated and stored
- grey hydrogen: manufacturing process produces carbon dioxide which is released into the air

Q: 1 **The widespread use of which type(s) of hydrogen will help in containing global warming?**

1. only green hydrogen
2. only green hydrogen and blue hydrogen
3. only blue hydrogen and grey hydrogen
4. only green hydrogen and grey hydrogen

Q: 2 **Hydrogen can be prepared in the laboratory by reacting metals with acids. However, most of the hydrogen manufactured in the industry is by reacting methane with water at a high temperature.**

Which of the following is the LIKELY reason why the reaction of metals with acids is NOT used to manufacture hydrogen on a large scale?

1. The raw materials used in the metal-acid reaction are expensive.
2. The metal-acid reaction requires a high temperature and pressure.
3. The hydrogen produced by the metal-acid reaction is acidic in nature.
4. The hydrogen produced by the metal-acid reaction has a lower calorific value.

Q: 3 **Electrolysis of water is another common way of producing hydrogen on an industrial scale.**

Hydrogen produced by the electrolysis of water CAN be green hydrogen, but NOT ALWAYS. Which of the following correctly explains why?

1. The electrolysis equipment may not have the capacity to capture and store carbon dioxide.
2. The hydrogen produced by electrolysis may be used to power polluting industries.
3. The use of water for electrolysis can deplete groundwater resources.
4. The energy used for electrolysis may be obtained from fossil fuels.

Q: 4 **Two statements are given - one labelled Assertion (A) and the other labelled Reason (R). Read the statements carefully and choose the option that correctly describes statements A and R.**

Assertion (A): Hydroelectric power plants are not the primary source of power generation in India.
Reason (R): Dams for hydroelectricity generation are best constructed in places with steep altitude gradient.

1. Both A and R are true, and R is the correct explanation for A.
2. Both A and R are true, but R is not a correct explanation for A.
3. A is true, but R is false.
4. A is false, but R is true.

Q: 5 **Which among the following is/are an indication of high contamination in a river?**

(i) low pH of the river water
(ii) existence of diverse life forms in the river
(iii) presence of mercury ions in the water
(iv) presence of E.coli bacteria in water

Choose the correct option from the following:

1. (i) and (iii)
2. (i) and (iv)
3. (i), (iii) and (iv)
4. (i), (ii), (iii) and (iv)

Q: 6 **Given below are 4 reasons. Identify ones which explain why we need to use our resources carefully.** **[2]**

1. because our needs are increasing
2. because all resources are not unlimited
3. because the population of humans is increasing rapidly
4. because we need to make these resources last for use by future generations

Q: 7 **Upcycling is a new trend of using waste products in their current form and creating new products. The image below shows an upcycled bottle table lamp.** **[1]**

State ONE difference between upcycling and recycling.

Q: 8 **Rainwater harvesting can be done by storing water in underground recharge wells or at the surface in check dams.** **[2]**

Give TWO advantages of underground water storage over check dams.

Q: 9 **Lily says that deforestation of vast areas and then reforestation by monoculture is not a sustainable way of forest management.** **[2]**

Give TWO disadvantages of reforestation by monoculture to support Lily's statement.

The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	2
2	1
3	4
4	2
5	3

Q.No	Teacher should award marks if students have done the following:	Marks
6	All 4 given reasons are correct. 0.5 marks can be awarded for identifying each correct reason. So if only 1 reason is identified correctly, give 0.5 marks, 2 reasons = 1 mark, 3 reasons = 1.5 marks and all 4 reasons = 2 marks.	2
7	Re-cycling involves processing waste to convert it into something absolutely new.	1
8	1 mark each for any two advantages: - no water loss to evaporation - no contamination by human and animal waste - does not allow breeding of mosquitoes (Accept any other valid point)	2
9	1 mark each for any TWO disadvantages of monoculture forests such as: - Monocultures decrease biodiversity of an area. - Monocultures cannot meet the requirements of local community for herbs, medicinal plants, fodder, etc. - Monocultures lead to decrease in diversity of soil insects and microorganisms. - Monocultures lead to depletion of soil nutrients.	2

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