

**SCIENCE SQP (2024-25)**  
**CLASS X**  
**(Science 086)**

**Max. Marks: 80**

**Time Allowed: 3 hours**

**General Instructions:**

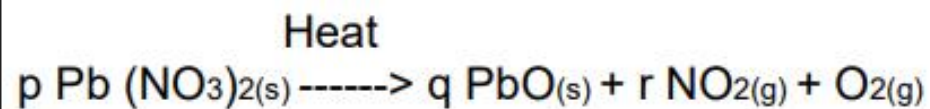
- 1. All questions would be compulsory. However, an internal choice of approximately 33% would be provided. 50% marks are to be allotted to competency-based questions.*
- 2. Section A would have 16 simple/complex MCQs and 04 Assertion-Reasoning type questions carrying 1 mark each.*
- 3. Section B would have 6 Short Answer (SA) type questions carrying 02 marks each.*
- 4. Section C would have 7 Short Answer (SA) type questions carrying 03 marks each.*
- 5. Section D would have 3 Long Answer (LA) type questions carrying 05 marks each.*
- 6. Section E would have 3 source based/case based/passage based/integrated units of assessment (04 marks each) with sub-parts of the values of 1/2/3 marks.*

### Section-A

Question 1 to 16 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions.

1

Identify 'p', 'q' and 'r' in the following balanced reaction



- A. 2,2,4
- B. 2,4,2
- C. 2,4,4
- D. 4,2,2

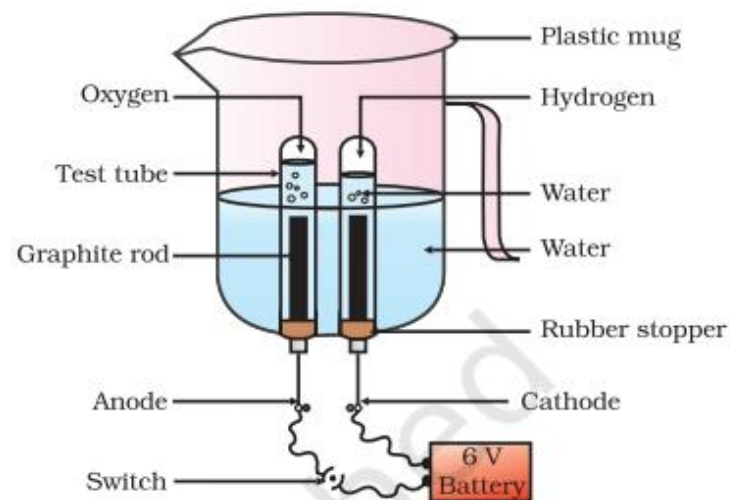
1



Let us perform some more decomposition reactions as given in Activities 1.7 and 1.8.

### Activity 1.7

- Take a plastic mug. Drill two holes at its base and fit rubber stoppers in these holes. Insert carbon electrodes in these rubber stoppers as shown in Fig. 1.6.
  - Connect these electrodes to a 6 volt battery.
  - Fill the mug with water such that the electrodes are immersed. Add a few drops of dilute sulphuric acid to the water.
  - Take two test tubes filled with water and invert them over the two carbon electrodes.
  - Switch on the current and leave the apparatus undisturbed for some time.
  - You will observe the formation of bubbles at both the electrodes. These bubbles displace water in the test tubes.
  - Is the volume of the gas collected the same in both the test tubes?
  - Once the test tubes are filled with the respective gases, remove them carefully.
  - Test these gases one by one by bringing a burning candle close to the mouth of the test tubes.
- CAUTION:** This step must be performed carefully by the teacher.
- What happens in each case?
  - Which gas is present in each test tube?



**Figure 1.6**  
Electrolysis of water

2

Match column I with column II and select the correct option using the given codes.

Column I	Column II
a. A metal that forms amphoteric oxides	(i) Ga
b. A metal which melts when kept on our palm	(ii) Au
c. A metal that reacts with nitric acid	(iii) Al
d. A metal which cannot displace hydrogen from acids	(iv) Mn

- A. a – (ii), b – (i), c – (iii), d – (iv)  
 B. a – (iii), b – (i), c – (iv), d – (ii)  
 C. a – (iv), b – (ii), c – (iii), d – (i)  
 D. a – (iii), b – (ii), c – (i), d – (iv)

1

**Table 3.2** Activity series : Relative reactivities of metals

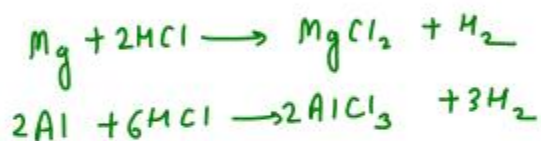
K	Potassium	Most reactive
Na	Sodium	
Ca	Calcium	
Mg	Magnesium	
Al	Aluminium	
Zn	Zinc	Reactivity decreases
Fe	Iron	
Pb	Lead	
[H]	[Hydrogen]	
Cu	Copper	
Hg	Mercury	
Ag	Silver	
Au	Gold	Least reactive

Kedar  
Nath  
Ca  
Mali  
Aloo  
zara  
Feke  
Pakata  
Mai  
Cute  
Haré  
Aayega  
Aur  
Pitega

K  
Na  
Ca  
Mg  
Al  
Zn  
Fe  
Pb  
H  
Cu  
Hg  
Ag  
Au  
Pt

### Activity 3.11

- Collect all the metal samples except sodium and potassium again. If the samples are tarnished, rub them clean with sand paper. CAUTION: Do not take sodium and potassium as they react vigorously even with cold water.
- Put the samples separately in test tubes containing dilute hydrochloric acid.
- Suspend thermometers in the test tubes, so that their bulbs are dipped in the acid.
- Observe the rate of formation of bubbles carefully.
- Which metals reacted vigorously with dilute hydrochloric acid?
- With which metal did you record the highest temperature?
- Arrange the metals in the decreasing order of reactivity with dilute acids.



Write equations for the reactions of magnesium, aluminium, zinc and iron with dilute hydrochloric acid.

Hydrogen gas is not evolved when a metal reacts with nitric acid. It is because  $\text{HNO}_3$  is a strong oxidising agent. It oxidises the  $\text{H}_2$  produced to water and itself gets reduced to any of the nitrogen oxides ( $\text{N}_2\text{O}$ ,  $\text{NO}$ ,  $\text{NO}_2$ ). But magnesium (Mg) and manganese (Mn) react with very dilute  $\text{HNO}_3$  to evolve  $\text{H}_2$  gas.

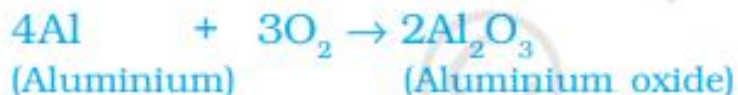
You must have observed in Activity 3.11, that the rate of formation of bubbles was the fastest in the case of magnesium. The reaction was also the most exothermic in this case. The reactivity decreases in the order  $\text{Mg} > \text{Al} > \text{Zn} > \text{Fe}$ . In the case of copper, no bubbles were seen and the temperature also remained unchanged. This shows that copper does not react with dilute HCl.



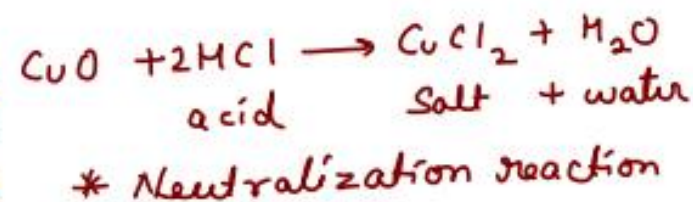
(Copper)

(Copper(II) oxide)

✓ Similarly, aluminium forms aluminium oxide.



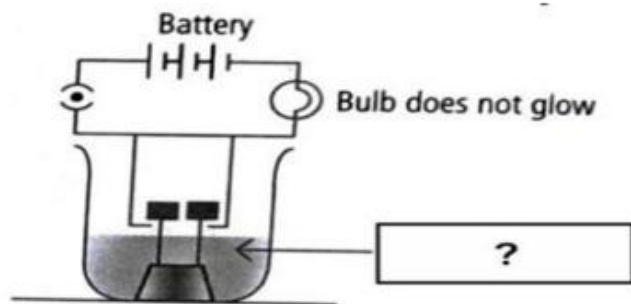
Recall from Chapter 2, how copper oxide reacts with hydrochloric acid. We have learnt that metal oxides are basic in nature. But some metal oxides, such as aluminium oxide, zinc oxide show both acidic as well as basic behaviour. Such metal oxides which react with both acids as well as bases to produce salts and water are known as amphoteric oxides. Aluminium oxide reacts in the following manner with acids and bases –



Most metal oxides are insoluble in water but some of these dissolve in water to form alkalis. Sodium oxide and potassium oxide dissolve in water to produce alkalis as follows –



3



1

The solution in the given figure is likely to be

- A.  $\text{HNO}_3$
- B.  $\text{C}_2\text{H}_5\text{OH}$
- C.  $\text{H}_2\text{SO}_4$
- D.  $\text{CO}_2$  in water

4

An aqueous solution 'A' turns the phenolphthalein solution pink. On addition of an aqueous solution 'B' to 'A', the pink colour disappears. Which of the following statement is true for the solutions 'A' and 'B'.

- A. A is strongly basic and B is a weak base.
- B. A is strongly acidic and B is a weak acid.
- C. A has a pH greater than 7 and B has a pH less than 7.
- D. A has a pH less than 7 and B has a pH greater than 7.



## 2.1.1 Acids and Bases in the Laboratory

### Activity 2.1

- ✓ Collect the following solutions from the science laboratory—hydrochloric acid (HCl), sulphuric acid (H<sub>2</sub>SO<sub>4</sub>), nitric acid (HNO<sub>3</sub>), acetic acid (CH<sub>3</sub>COOH), sodium hydroxide (NaOH), calcium hydroxide [Ca(OH)<sub>2</sub>], potassium hydroxide (KOH), magnesium hydroxide [Mg(OH)<sub>2</sub>], and ammonium hydroxide (NH<sub>4</sub>OH).
- Put a drop of each of the above solutions on a watch-glass one by one and test with a drop of the indicators shown in Table 2.1.
- What change in colour did you observe with red litmus, blue litmus, phenolphthalein and methyl orange solutions for each of the solutions taken?
- Tabulate your observations in Table 2.1.

**Table 2.1**

Sample solution	Red litmus solution	Blue litmus solution	Phenolphthalein solution	Methyl orange solution
	Base → Blue Acid → No change	Acid → Red Base → No change	Base → Pink Acid → Colourless and Neutral	Acid → Red Base → Yellow

These indicators tell us whether a substance is acidic or basic by change in colour. There are some substances whose odour changes in acidic or basic media. These are called olfactory indicators. Let us try out some of these indicators.

5

When 50g of lead powder is added to 300 ml of blue copper sulphate solution, after a few hours, the solution becomes colourless. This is an example of

- A. Combination reaction
- B. Decomposition reaction
- C. Displacement reaction
- D. Double displacement reaction

**Table 3.2** Activity series : Relative reactivities of metals

K	Potassium		Most reactive
Na	Sodium		Reactivity decreases
Ca	Calcium		
Mg	Magnesium		
Al	Aluminium		
Zn	Zinc		
Fe	Iron		
Pb	Lead		
[H]	[Hydrogen]		
Cu	Copper		
Hg	Mercury		
Ag	Silver	Least reactive	
Au	Gold		

Kedar  
Nath  
Ca  
Mali  
Aloo  
zara  
Feke  
Pakata  
Mai  
Cute  
Haré  
Aayega  
Aur  
Pitega

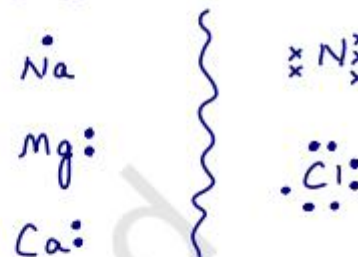
K  
Na  
Ca  
Mg  
Al  
Zn  
Fe  
Pb  
H  
Cu  
Hg  
Ag  
Au  
Pt

- 6 The electronic configuration of three elements X, Y and Z are X- 2, 8, 7; Y- 2, 8, 2; and Z - 2, 8
- A. Y and Z are metals
  - B. Y and X are non-metals
  - C. X is a non-metal and Y is a metal
  - D. Y is a non-metal and Z is a metal

**Table 3.3** Electronic configurations of some elements

Type of element	Element	Atomic number	Number of electrons in shells			
			K	L	M	N
Noble gases	Helium (He)	2	2			
	Neon (Ne)	10	2	8		
	Argon (Ar)	18	2	8	8	
Metals	Sodium (Na)	11	2	8	1	
	Magnesium (Mg)	12	2	8	2	
	Aluminium (Al)	13	2	8	3	
	Potassium (K)	19	2	8	8	1
	Calcium (Ca)	20	2	8	8	2
Non-metals	Nitrogen (N)	7	2	5		
	Oxygen (O)	8	2	6		
	Fluorine (F)	9	2	7		
	Phosphorus (P)	15	2	8	5	
	Sulphur (S)	16	2	8	6	
	Chlorine (Cl)	17	2	8	7	

\* Electron-dot structure



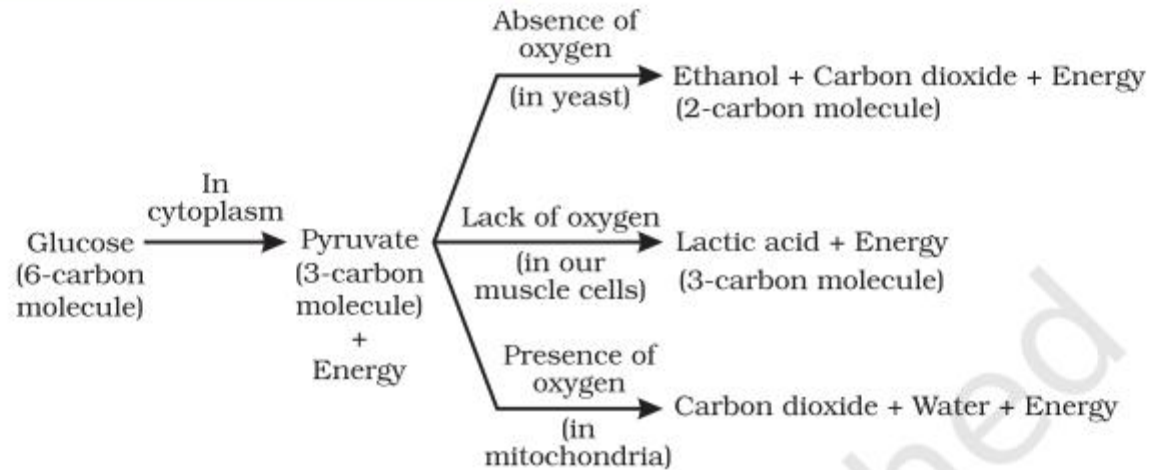
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Which of the following is an endothermic reaction?

- A. Burning of candle.
- B. Cooking of food.
- C. Decomposition of Vegetable matter.
- D. Reaction of Sodium with air

- 8 During cellular oxidation of Glucose, ATP is produced along with formation of other products in this reaction. Which of the following events is associated with production of maximum ATP molecules per molecule of Glucose during this process? Synthesis of
- A. ethanol in yeast
  - B. lactic acid in muscle cells
  - C. carbon dioxide in yeast cells
  - D. carbon dioxide in human cells

process breaks up the three-carbon pyruvate molecule to give three molecules of carbon dioxide. The other product is water. Since this process takes place in the presence of air (oxygen), it is called **aerobic respiration**. The release of energy in this aerobic process is a lot greater than in the anaerobic process. Sometimes, when there is a lack of oxygen in our muscle cells, another pathway for the break-down of pyruvate is taken. Here the pyruvate is converted into lactic acid which is also a three-carbon molecule. This build-up of lactic acid in our muscles during sudden activity causes cramps.



**Figure 5.8** Break-down of glucose by various pathways

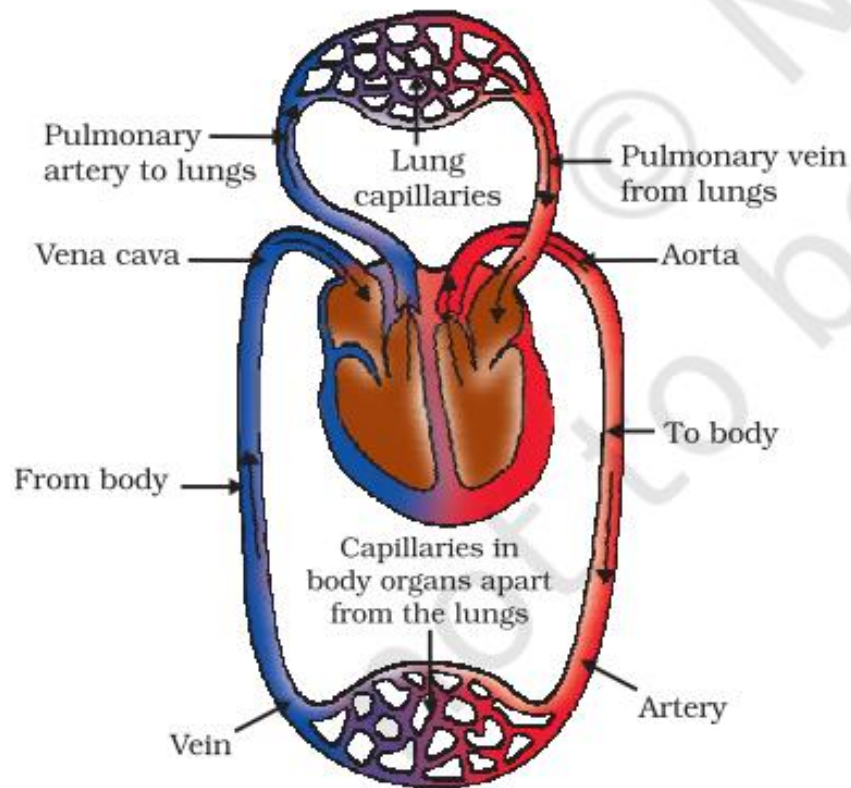
The energy released during cellular respiration is immediately used to synthesise a molecule called ATP which is used to fuel all other activities in the cell. In these processes, ATP is broken down giving rise to a fixed amount of energy which can drive the endothermic reactions taking place in the cell.

- 9 | During which of the following stages of the circulation of blood in a normal human being, the oxygenated blood is pumped to all parts of the body?
- A. contraction of the left atrium
  - B. contraction of left ventricle
  - C. relaxation of the right atrium
  - D. relaxation of the right ventricle



**Figure 5.10**  
*Schematic sectional view of the human heart*

chamber of the heart on the left, the left atrium. The left atrium relaxes when it is collecting this blood. It then contracts, while the next chamber, the left ventricle, relaxes, so that the blood is transferred to it. When the muscular left ventricle contracts in its turn, the blood is pumped out to the body. De-oxygenated blood comes from the body to the upper chamber on the right, the right atrium, as it relaxes. As the right atrium contracts, the corresponding lower chamber, the right ventricle, dilates. This transfers blood to the right ventricle, which in turn pumps it to the lungs for oxygenation. Since ventricles have to pump blood into various organs, they have thicker muscular walls than the atria do. Valves ensure that blood does not flow backwards when the atria or ventricles contract.



**Figure 5.11**

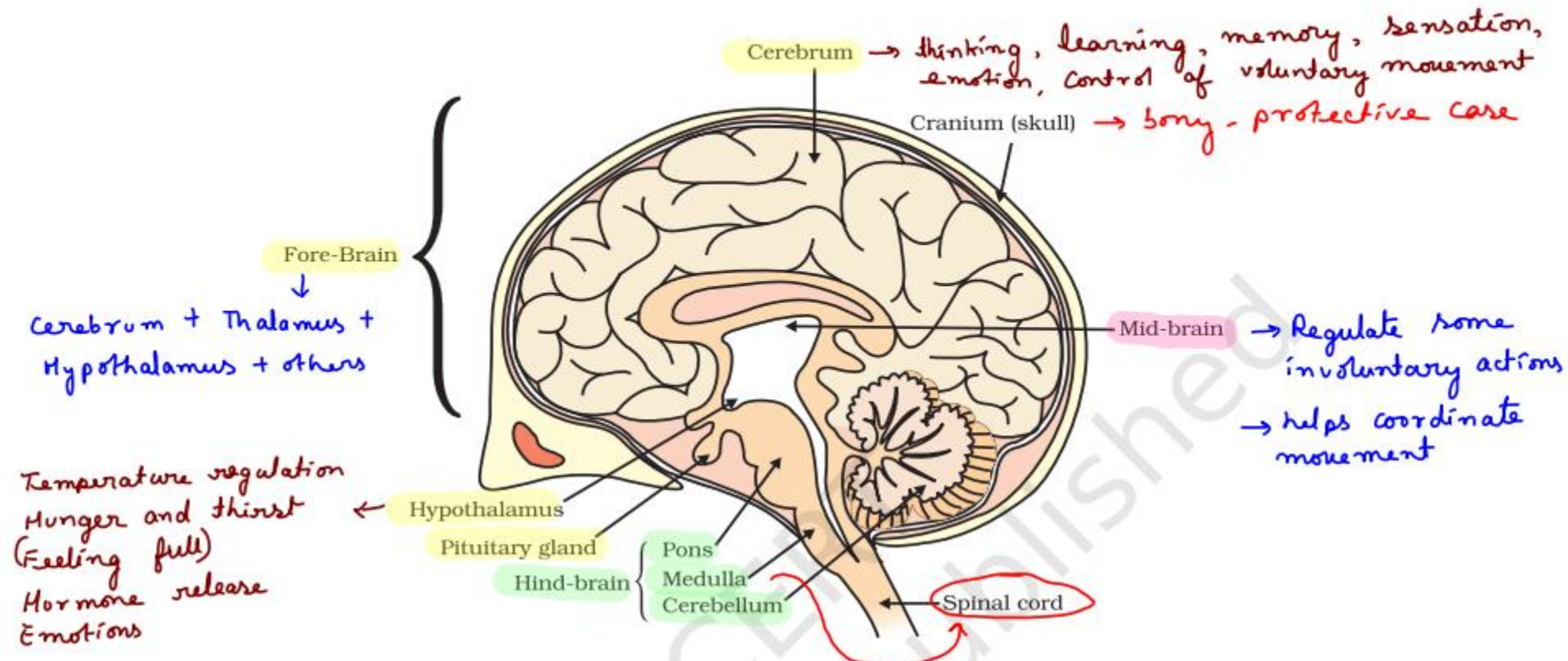
### **Oxygen enters the blood in the lungs**

The separation of the right side and the left side of the heart is useful to keep oxygenated and de-oxygenated blood from mixing. Such separation allows a highly efficient supply of oxygen to the body. This is useful in animals that have high energy needs, such as birds and mammals, which constantly use energy to maintain their body temperature. In animals that do not use energy for this purpose, the body temperature depends on the temperature in the environment. Such animals, like amphibians or many reptiles have three-chambered hearts, and tolerate some mixing of the oxygenated and de-oxygenated blood streams. Fishes, on the other hand, have only two chambers to their hearts, and the blood is pumped to the gills. is oxygenated there. and passes directly

10 | Which of the following adaptations in herbivores helps in digestions of cellulose?

- A. Longer large intestine
- B. Smaller large intestine
- C. Smaller small intestine
- D. Longer small intestine

- 11 | There was a cerebellar dysfunction in a patient. Which of the following activities will get disturbed in this patient as a result of this?
- A. Salivation
  - B. Hunger control
  - C. Posture and balance
  - D. Regulation of blood pressure



**Figure 6.3** Human brain

Study the labelled diagram of the human brain. We have seen that the different parts have specific functions. Can we find out the function of each part?

Let us look at the other use of the word 'reflex' that we have talked about in the introduction. Our mouth waters when we see food we like without our meaning to. Our hearts beat without our thinking about it. In fact, we cannot control these actions easily by thinking about them even if we wanted to. Do we have to think about or remember to breathe or digest food? So, in between the simple reflex actions like change in the size of the pupil, and the thought out actions such as moving a chair, there is another set of muscle movements over which we do not

Medulla

- Involuntary actions like
- Blood pressure regulation
- Salivation
- Vomiting

Cerebellum

- Precision of voluntary movements
- Posture and balance

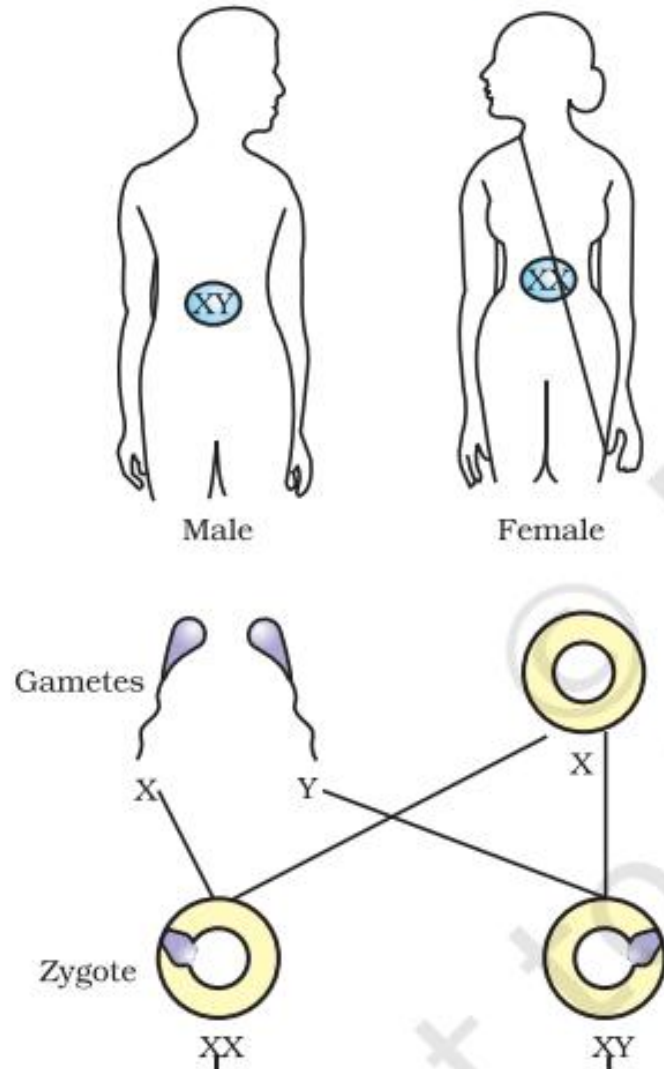
- 12 | In snails individuals can begin life as male and depending on environmental conditions they can become female as they grow. This is because
- A. male snails have dominant genetic makeup.
  - B. female snails have dominant genetic makeup.
  - C. expression of sex chromosomes can change in a snail's life time.
  - D. sex is not genetically determined in snails.

## 8.2.4 Sex Determination

We have discussed the idea that the two sexes participating in sexual reproduction must be somewhat different from each other for a number

of reasons. How is the sex of a newborn individual determined? Different species use very different strategies for this. Some rely entirely on environmental cues. Thus, in some animals like a few reptiles, the temperature at which fertilised eggs are kept determines whether the animals developing in the eggs will be male or female. In other animals, such as snails, individuals can change sex, indicating that sex is not genetically determined. However, in human beings, the sex of the individual is largely genetically determined. In other words, the genes inherited from our parents decide whether we will be boys or girls. But so far, we have assumed that similar gene sets are inherited from both parents. If that is the case, how can genetic inheritance determine sex?

The explanation lies in the fact that all human chromosomes are not paired. Most human chromosomes have a maternal and a paternal copy, and we have 22 such pairs. But one pair, called the sex chromosomes, is odd in not always being a perfect pair. Women have a perfect pair of sex chromosomes, both called X. But men have a mismatched pair in which one is a normal-sized X while the other is a short one called Y. So women are XX,



In the following cases, a ray is incident on a concave mirror. In which case is the angle of incidence equal to zero?

- A. A ray parallel to the principal axis.
- B. A ray passing through the centre of curvature and incident obliquely.
- C. A ray passing through the principal focus and incident obliquely.
- D. A ray incident obliquely to the principal axis, at the pole of the mirror.

- (iii) A ray passing through the centre of curvature of a concave mirror or directed in the direction of the centre of curvature of a convex mirror, after reflection, is reflected back along the same path. This is illustrated in Fig.9.5 (a) and (b). The light rays come back along the same path because the incident rays fall on the mirror along the normal to the reflecting surface.

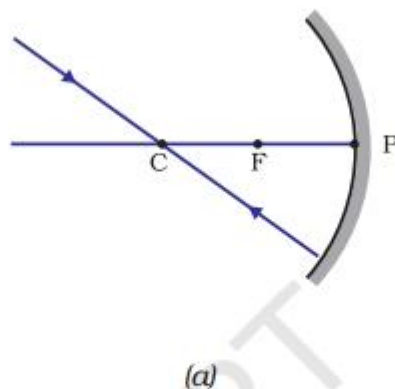


Figure 9.4

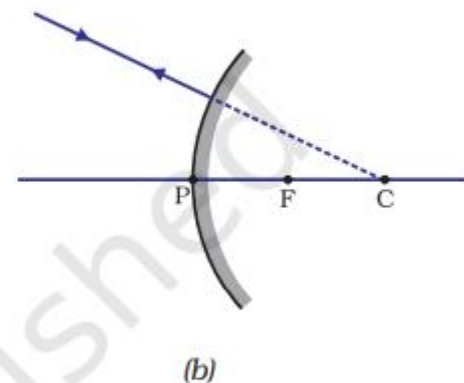
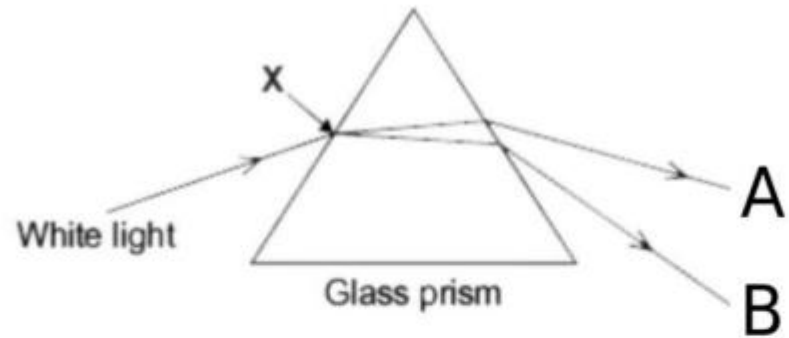


Figure 9.5



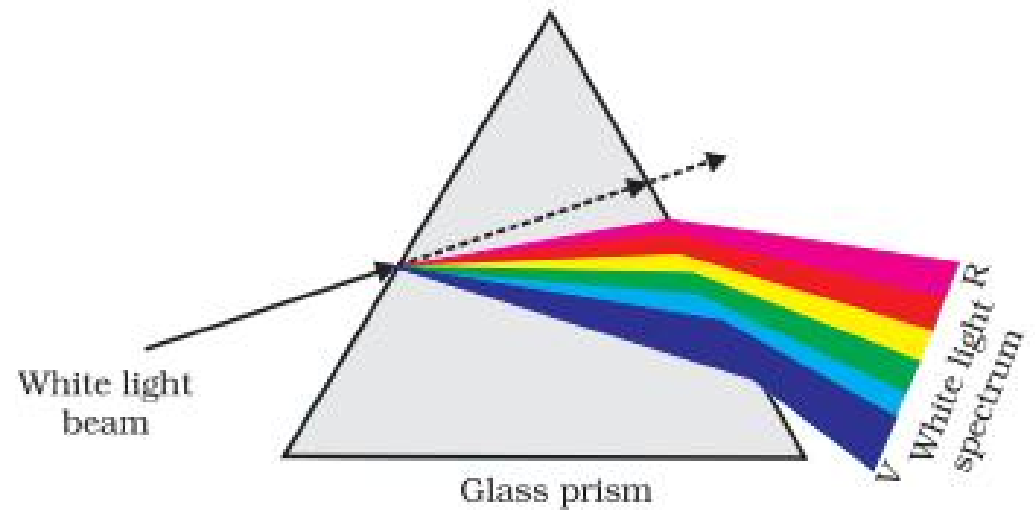
Choose the correct option for the colour of rays for A and B.

	Colour of Ray A	Colour of Ray B
A.	Blue	Red
B.	Green	Yellow
C.	Red	Violet
D.	Violet	Indigo

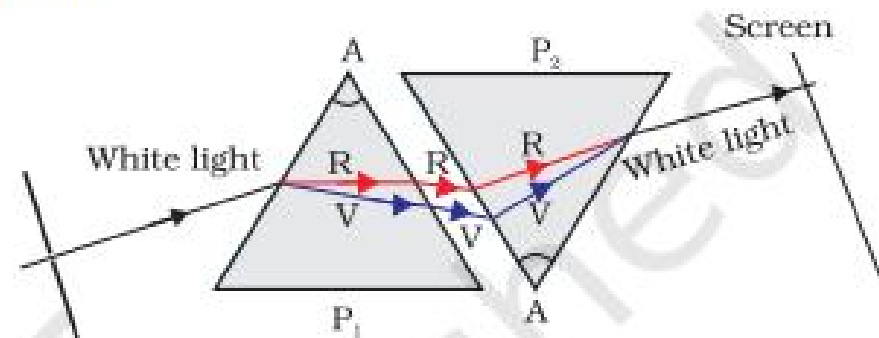


The prism has probably split the incident white light into a band of colours. Note the colours that appear at the two ends of the colour band. What is the sequence of colours that you see on the screen? The various colours seen are Violet, Indigo, Blue, Green, Yellow, Orange and Red, as shown in Fig. 10.5. The acronym VIBGYOR will help you to remember the sequence of colours. The band of the coloured components of a light beam is called its spectrum. You might not be able to see all the colours separately. Yet something makes each colour distinct from the other. The splitting of light into its component colours is called dispersion.

You have seen that white light is dispersed into its seven-colour components by a prism. Why do we get these colours? Different colours of light bend through different angles with respect to the incident ray, as they pass through a prism. The red light bends the least while the violet the most. Thus the rays of each colour emerge along different paths and thus become distinct. It is the band of distinct colours that we see in a spectrum.



**Figure 10.5** Dispersion of white light by the glass prism



**Figure 10.6** Recombination of the spectrum of white light

15

Identify the incorrect statement

'The energy available to the producers is maximum' because:

- A. It is the first trophic level which absorbs 1% of light energy directly from the source.
- B. It utilizes the most of the chemical energy for its own respiration, growth, reproduction, movement etc.
- C. It utilizes 10% of light energy and transfers the rest to the next trophic level.
- D. It transfers only 10% of light energy to the next trophic level.

16 | Which of the following is not a role of decomposers in the ecosystem?

- A. Natural replenishment of soil.
- B. Enrichment of oxygen in atmosphere.
- C. Waste decomposition.
- D. Break-down of dead remains.

Question No. 17 to 20 consist of two statements – **Assertion (A)** and **Reason (R)**. Answer these questions by selecting the appropriate option given below:

- A. Both A and R are true, and R is the correct explanation of A.
- B. Both A and R are true, and R is not the correct explanation of A.
- C. A is true but R is false.
- D. A is false but R is true

- 17 | **Assertion (A):** On adding dil. HCl to a test tube containing a substance 'X', a colourless gas is produced which gives a pop sound when a burning match stick is brought near it.
- | **Reason (R):** In this reaction metal 'X' is displaced by Hydrogen.

Question No. 17 to 20 consist of two statements – **Assertion (A)** and **Reason (R)**. Answer these questions by selecting the appropriate option given below:

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- B. Both A and R are true, and R is not the correct explanation of A.
- C. A is true but R is false.
- D. A is false but R is true

- 18 | **Assertion (A):** The number of chromosomes in a cell and in a germ cell is not the same in any species.
- | **Reason (R):** When 2 germ cells combine they restore the normal number of chromosomes in a species.

Question No. 17 to 20 consist of two statements – **Assertion (A)** and **Reason (R)**. Answer these questions by selecting the appropriate option given below:

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- B. Both A and R are true, and R is not the correct explanation of A.
- C. A is true but R is false.
- D. A is false but R is true

- 19 | **Assertion (A):** A convex mirror always forms an image behind it and the image formed is virtual.  
| **Reason (R):** According to the sign convention, the focal length of a convex mirror is positive.

Question No. 17 to 20 consist of two statements – **Assertion (A)** and **Reason (R)**. Answer these questions by selecting the appropriate option given below:

- A. Both A and R are true, and R is the correct explanation of A.
- B. Both A and R are true, and R is not the correct explanation of A.
- C. A is true but R is false.
- D. A is false but R is true

- 20 | **Assertion (A):** If the lions are removed from a food chain it will not affect the food chain, however if the plants are removed from a food chain it will disturb the ecosystem.
- | **Reason (R):** Plants are producers who can make food using sunlight, while lions are consumers.

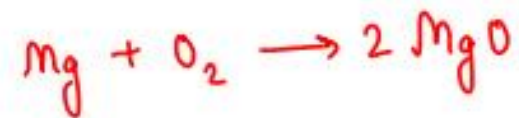
### Section-B

Question No. 21 to 26 are very short answer questions

21	Identify the type of each of the following reactions stating the reason for your answers. A. $\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe} + \text{heat}$ B. $\text{Pb}(\text{NO}_3)_2 + 2\text{KI} \rightarrow \text{PbI}_2(\downarrow) + 2\text{KNO}_3$	2
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21	A. Exothermic/Displacement reaction/Redox reaction.	(0.5)
	Heat is evolved or a More reactive element displaces a less reactive element or aluminium reduces iron (II) oxide to iron	(0.5)
	B. Double displacement / Precipitation reaction	(0.5)
	As there is an exchange of ions between reactants and products / (Yellow) precipitate (of Lead iodide) is formed	(0.5)





You must have observed that magnesium ribbon burns with a dazzling white flame and changes into a white powder. This powder is magnesium oxide. It is formed due to the reaction between magnesium and oxygen present in the air.

### Activity 1.2

- Take lead nitrate solution in a test tube.
- Add potassium iodide solution to this.
- What do you observe?

### Activity 1.3

- Take a few zinc granules in a conical flask or a test tube.
- Add dilute hydrochloric acid or sulphuric acid to this (Fig. 1.2).
- CAUTION:** Handle the acid with care.
- Do you observe anything happening around the zinc granules?
- Touch the conical flask or test tube. Is there any change in its temperature?



From the above three activities, we can say that any of the following observations helps us to determine whether a chemical reaction has taken place –

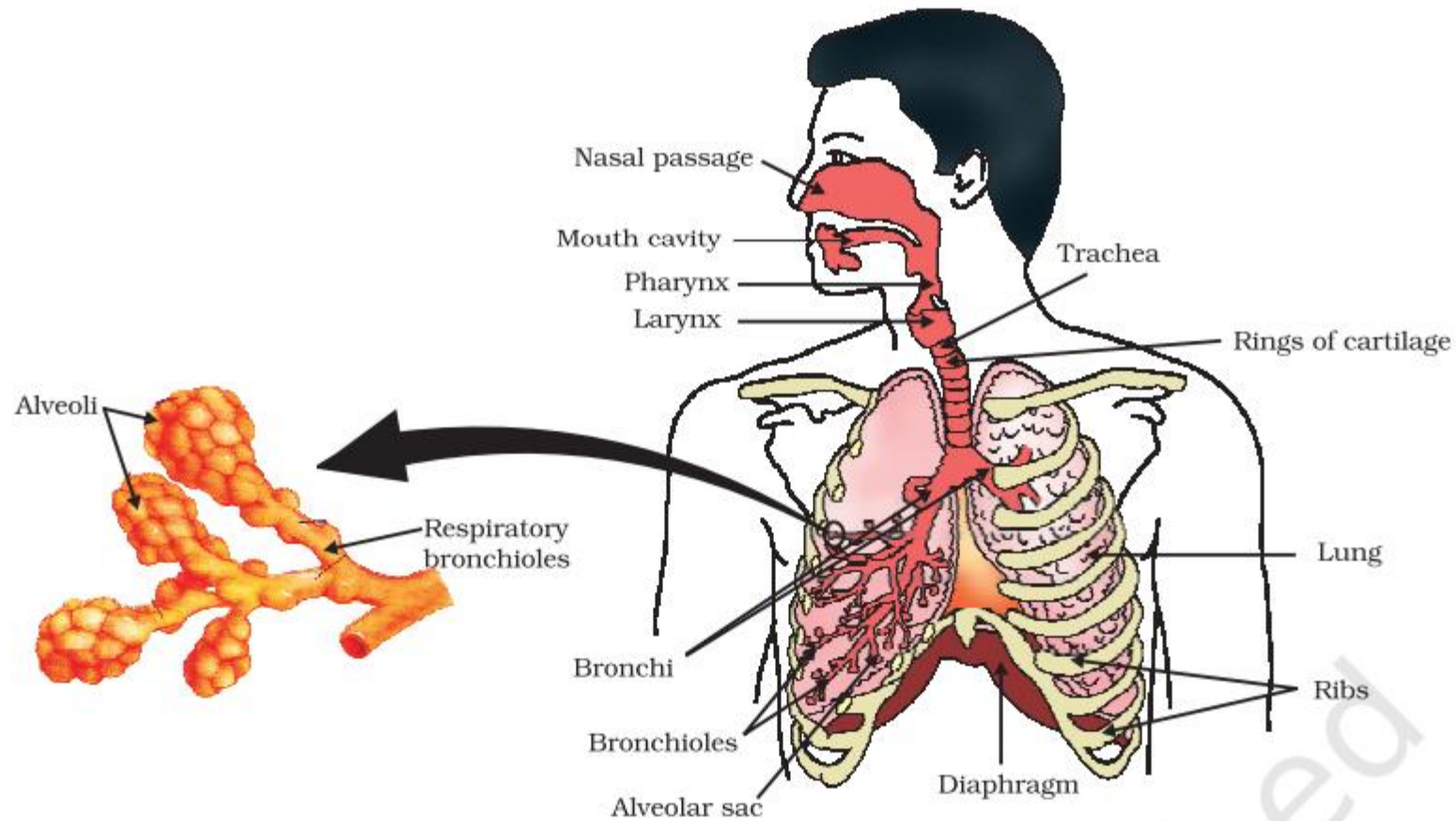
- change in state

22 Differentiate between alveoli and nephron on the basis of the following points:

2

S. No.	Feature	Alveoli	Nephron
1	Structure and location		
2	Function		

S. No.	Feature	Alveoli	Nephron
1	Structure and location	Balloon like structures present at the terminal ends of bronchioles in lungs	Tubular structure present in kidneys
2	Function	Exchange of gases	Filtration of blood to form urine

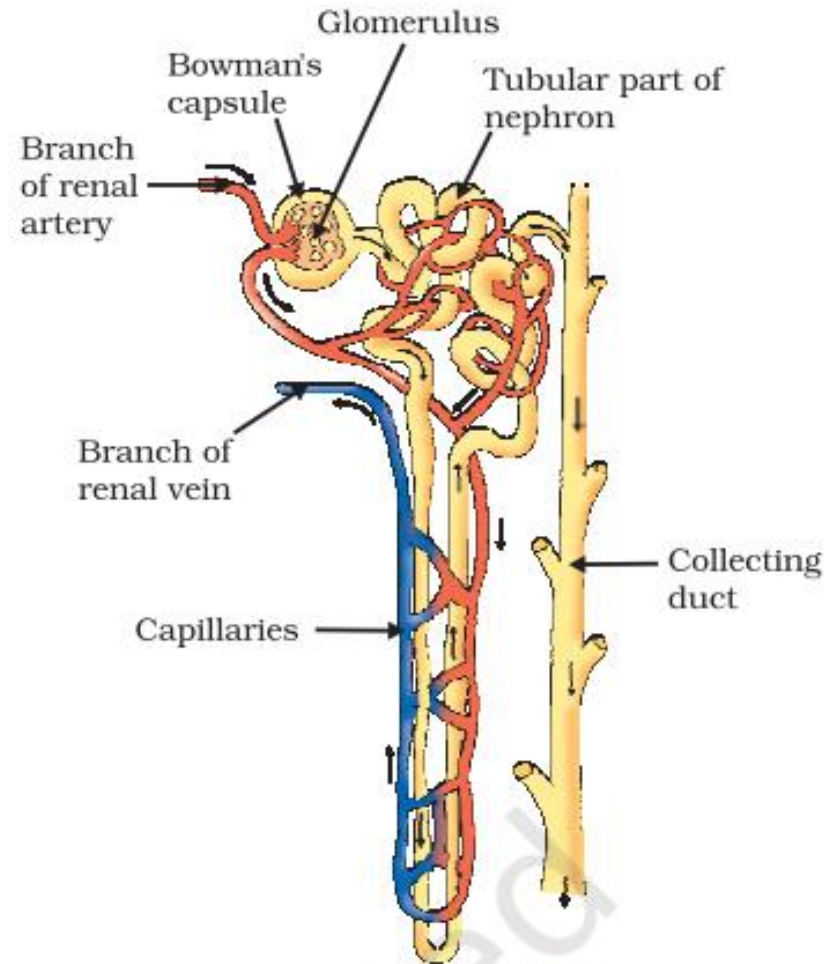


**Figure 5.9** Human respiratory system

**Do You Know?**  
Smoking is injurious to health.  
Lung cancer is one of

Within the lungs, the passage divides into smaller and smaller tubes which finally terminate in balloon-like structures which are called alveoli (singular-alveolus). The alveoli provide a surface where the exchange of gases can take place. The walls of the alveoli contain an extensive network of blood-vessels. As we have seen

like in the lungs, is a cluster of very thin-walled blood capillaries. Each capillary cluster in the kidney is associated with the cup-shaped end of a coiled tube called Bowman's capsule that collects the filtrate (Fig. 5.14). Each kidney has large numbers of these filtration units called nephrons packed close together. Some substances in the initial filtrate, such as glucose, amino acids, salts and a major amount of water, are selectively re-absorbed as the urine flows along the tube. The amount of water re-absorbed depends on how much excess water there is in the body, and on how much of dissolved waste there is to be excreted. The urine forming in each kidney eventually enters a long tube, the ureter, which connects the kidneys with the urinary bladder. Urine is stored in the urinary bladder until the pressure of the expanded bladder leads to the urge to pass it out through the urethra. The bladder is muscular, so it is under nervous control, as we have discussed elsewhere. As a result, we can usually control the urge to urinate.



**Figure 5.14**  
Structure of a nephron

23	<u>Attempt either option A or B.</u>	2
	<p>A. List the steps for the synthesis of glucose by the plants. What special feature is found in desert plants related to this process?</p> <p style="text-align: center;"><b>OR</b></p> <p>B. Explain the role of the following enzymes in the process of digestion of food in humans:</p> <p>(i) Salivary amylase</p> <p>(ii) Pepsin</p> <p>(iii) Trypsin</p> <p>(iv) Lipase</p>	

23

Students to attempt either option A or B.

2

A. Steps of synthesis of glucose in plants:

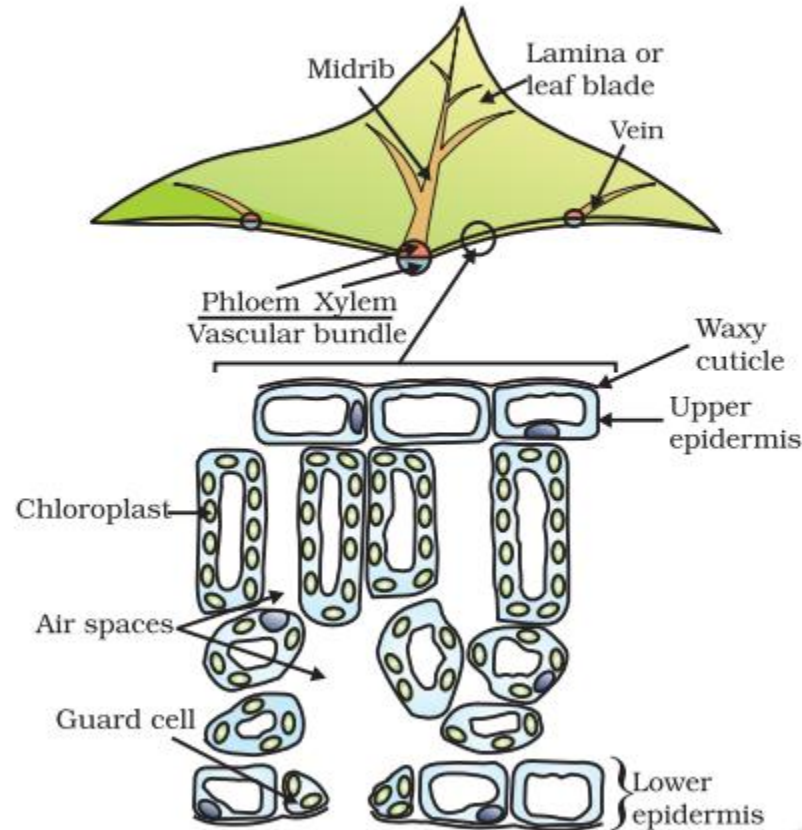
- Absorption of light energy by chlorophyll
- Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen
- Reduction of carbon dioxide into carbohydrates.
- Desert plants take up carbon dioxide at night and prepare an intermediate which is acted upon by the energy absorbed by the chlorophyll during the day. (0.5 x 4)

**OR**

B.

- Salivary amylase – breaks down starch which is a complex molecule to sugar.
- Pepsin – Helps to digest proteins in stomach.
- Trypsin – It helps in digesting proteins to amino acids.
- Lipase – Breaking down of emulsified fats to fatty acids and glycerol. (0.5 x 4)

Let us now see what actually happens during the process of photosynthesis. The following events occur during this process –



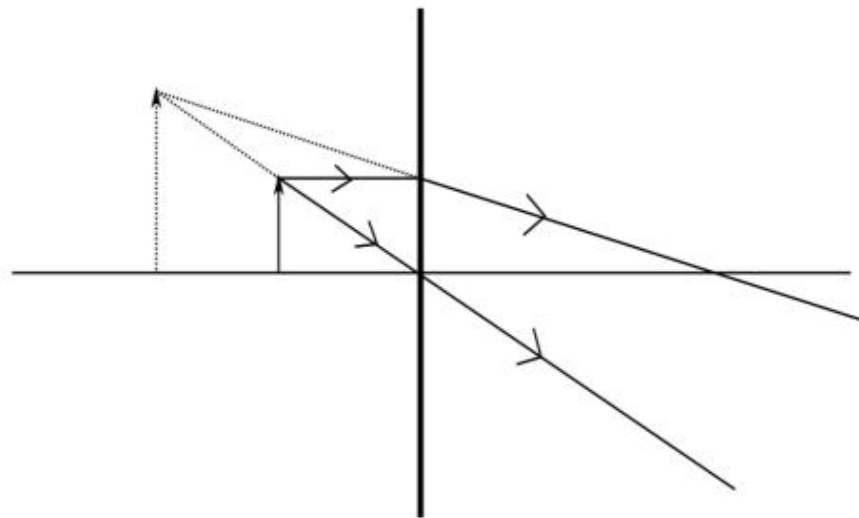
**Figure 5.1**  
Cross-section of a leaf

- (i) Absorption of light energy by chlorophyll.
- (ii) Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.
- (iii) Reduction of carbon dioxide to carbohydrates.

These steps need not take place one after the other immediately. For example, desert plants take up carbon dioxide at night and prepare an intermediate which is acted upon by the energy absorbed by the chlorophyll during the day.

Let us see how each of the components of the above reaction are necessary for photosynthesis.

If you carefully observe a cross-section of a leaf under the microscope (shown in Fig. 5.1), you will notice that some cells contain green dots. These green dots are cell organelles called chloroplasts which contain chlorophyll. Let us do an activity which demonstrates that chlorophyll is essential for photosynthesis.



The above figure shows the formation of an image by a lens shown by a thick line.

Analyse the figure and answer the following questions.

- What is the type of lens used?
- What is the nature of the image?
- If the image is formed at a distance of 30 cm from the lens and the image is twice the size of the object, then where is the object placed?

A. The lens is a convex lens.

B. The image is virtual.

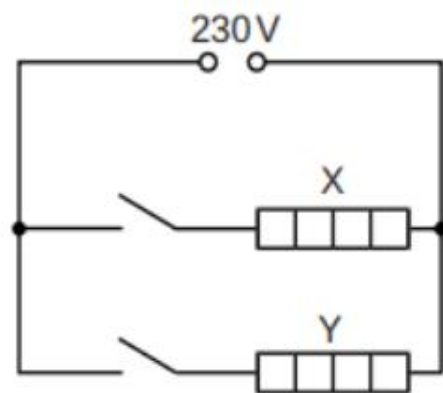
C. Magnification for lens =  $\frac{v}{u} = \frac{h_i}{h_o} = 2$ .

$$\frac{-30\text{cm}}{u} = 2$$

Hence  $u = -15\text{ cm}$

Attempt either option A or B.

A.



The electric circuit (above figure) in a clothes dryer contains two heaters X and Y in parallel. The above figure shows the circuit connected to a 230 V power supply. When both switches are closed, the current in X is 3.5 A.

Analyse the circuit given above and answer the following questions.

- Calculate the power developed in heater X.
- If the resistance of X is double that of Y calculate the current in heater Y.

Student to attempt either A or B.

A.  $P = VI$

$$= 230 \times 3.5 = 805 \text{ W}$$

$I \propto \frac{1}{R}$ , so half the resistance means double the current.

Therefore, current in Y = 7.0 A.

(1)

(1)



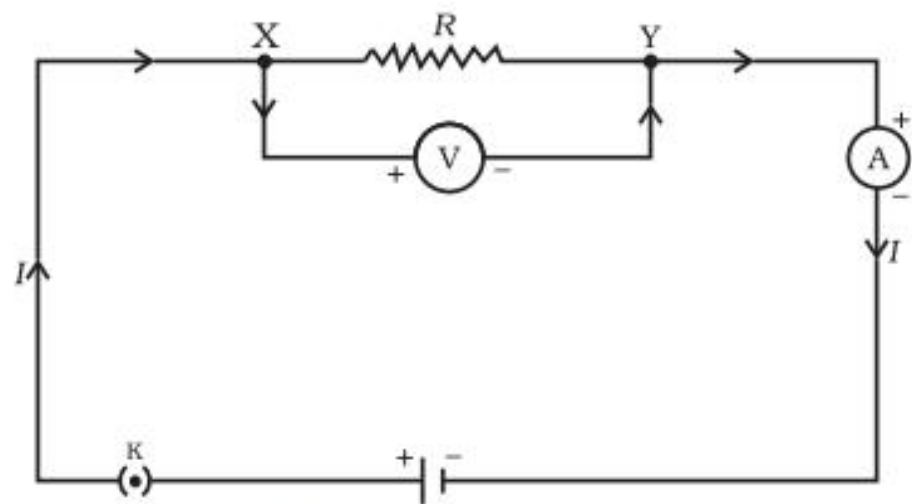
$$W = QV = VIt = I^2Rt = \frac{V^2t}{R} \text{ joule}$$

$$P = \frac{W}{t} = VI = I^2R = \frac{V^2}{R} \text{ watt}$$

Applying Ohm's law [Eq. (11.5)], we get

$$H = I^2 Rt \quad (11.21)$$

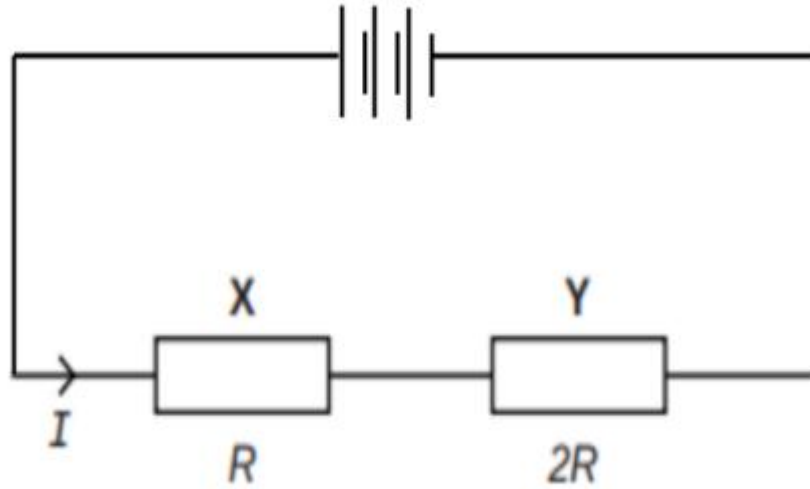
This is known as **Joule's law of heating**. The law implies that heat produced in a resistor is (i) directly proportional to the square of current for a given resistance, (ii) directly proportional to resistance for a given current, and (iii) directly proportional to the time for which the current flows through the resistor. In practical situations, when an electric appliance is connected to a known voltage source, Eq. (11.21) is used after calculating the current through it, using the relation  $I = V/R$ .



**Figure 11.13**

*A steady current in a purely resistive electric circuit*

B.



The above figure shows two resistors X and Y connected in series to a battery. The power dissipated for this combination is  $P_1$ . When these resistors are connected in parallel to the same battery then the power dissipated is given by  $P_2$ . Find out the ratio  $\frac{P_1}{P_2}$ .

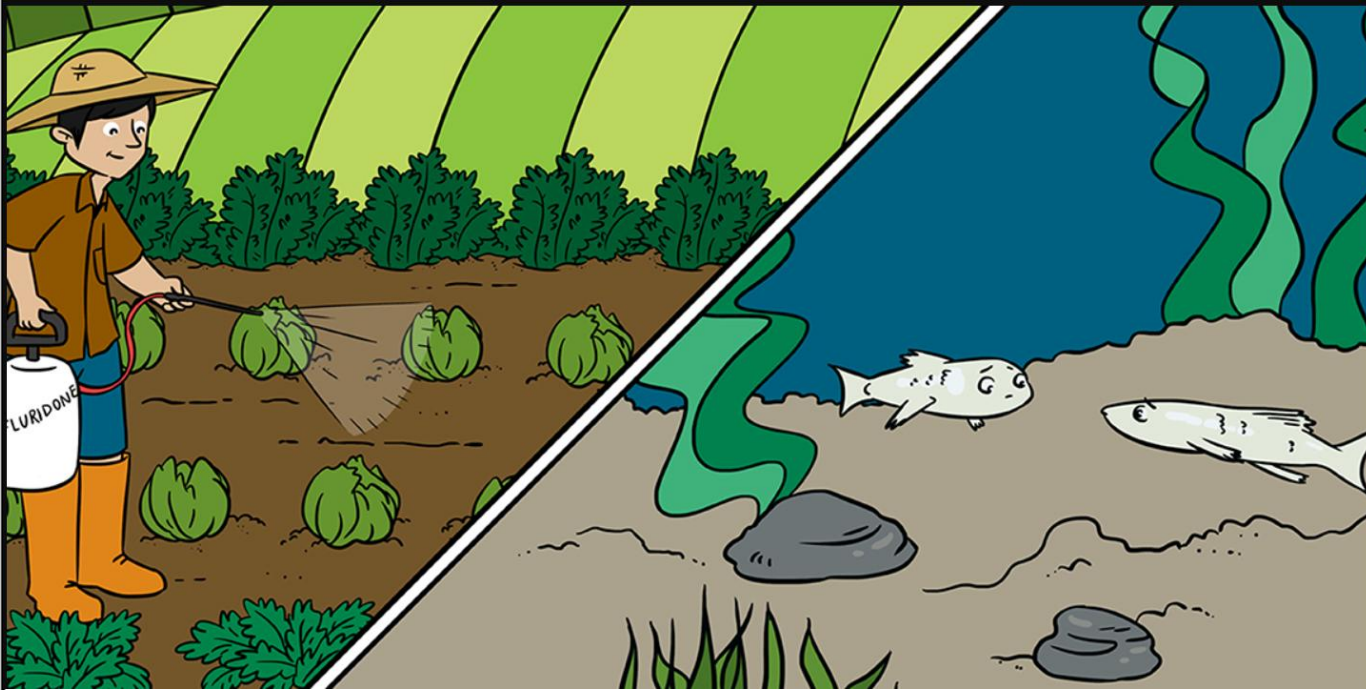
B. For series total resistance is  $R+2R = 3R$

$$P_1 = \frac{V^2}{3R}$$

For parallel total Resistance is  $\frac{2R}{3}$ .

$$P_2 = \frac{V^2}{2R/3} = \frac{3V^2}{2R}$$

$$\frac{P_1}{P_2} = \frac{2}{9}$$



What impact will the process shown in the image have on Humans if they occupy the last trophic level? Explain.

Pesticides are non-biodegradable/ keep getting accumulated at each trophic level, / persist for longer time/ and thus last trophic level has highest concentration/ humans will have the highest concentration of pesticides/ leads to bio-magnification. (any 2 points)

### Section-C

Question No. 27 to 33 are short answer questions

- 27 A. Anirudh took two metal oxides; aluminium oxide and magnesium oxide as shown in the pictures given below. But he forgot to label them. How will you guide/ help Anirudh to identify the oxides and label them?

3



- A. Aqueous solution of magnesium oxide turns red litmus to blue. Aluminium oxide is amphoteric and insoluble in water. Thus, it does not change the colour of either blue or red litmus.

**OR**

Magnesium oxide reacts with acid only whereas Aluminium oxide reacts with acids and bases, which are amphoteric. (1)

B. In an activity Aishu was given two substances; Copper Sulphide ( $\text{Cu}_2\text{S}$ ) and Copper Oxide ( $\text{Cu}_2\text{O}$ ) to obtain copper from these compounds. She was able to extract Copper successfully. Illustrate with the help of chemical equations how Aishu might have completed the activity.

B.



### 3.4.3 Extracting Metals Low in the Activity Series

Metals low in the activity series are very unreactive. The oxides of these metals can be reduced to metals by heating alone. For example, cinnabar (HgS) is an ore of mercury. When it is heated in air, it is first converted into mercuric oxide (HgO). Mercuric oxide is then reduced to mercury on further heating.

Silver



Similarly, copper which is found as Cu<sub>2</sub>S in nature can be obtained from its ore by just heating in air.

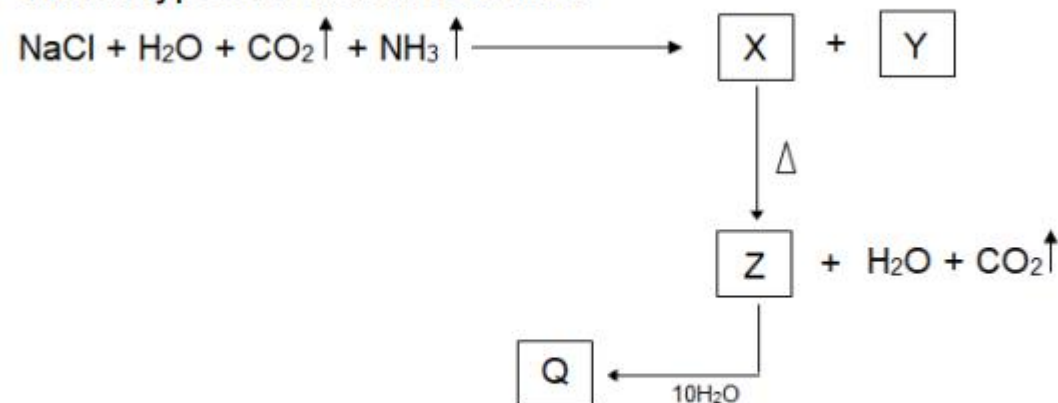
Copper



Attempt either option A or B.

A.

- (i) In the given series of reactions, name the compounds X and Z.  
 (ii) Which type of reaction is X to Z?



- (iii) You are given 3 unknown solutions A, B, and C with pH values of 6, 8 and 9.5 respectively. In which solution will the maximum number of hydronium ions be present? Arrange the given samples in the increasing order of  $\text{H}^+$  ion concentration.

3

A.

- (i)  $\text{X} = \text{NaHCO}_3$ ;  $\text{Z} = \text{Na}_2\text{CO}_3$   
 (ii) Decomposition reaction  
 (iii) Solution A  
 (iv) Increasing order of  $\text{H}^+$  ions  $\text{C} < \text{B} < \text{A}$

(0.5+0.5)

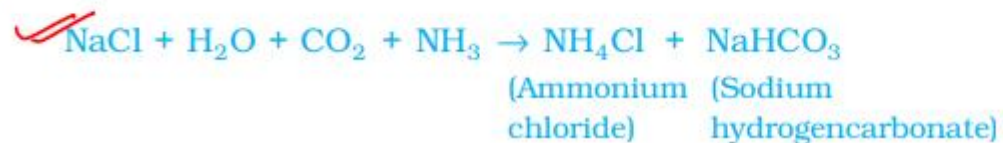
(0.5)

(0.5)

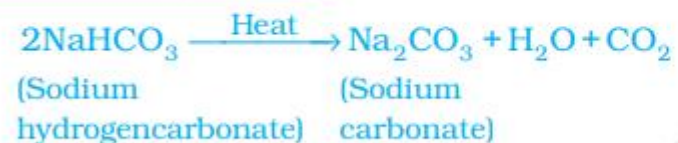
(1)

### Baking soda

The baking soda is commonly used in the kitchen for making tasty crispy pakoras, etc. Sometimes it is added for faster cooking. The chemical name of the compound is sodium hydrogencarbonate (NaHCO<sub>3</sub>). It is produced using sodium chloride as one of the raw materials.



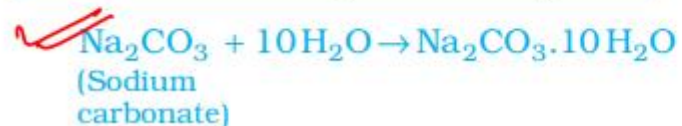
Did you check the pH of sodium hydrogencarbonate in Activity 2.14? Can you correlate why it can be used to neutralise an acid? It is a mild non-corrosive basic salt. The following reaction takes place when it is heated during cooking –



Sodium hydrogencarbonate has got various uses in the household.

### Washing soda

Another chemical that can be obtained from sodium chloride is Na<sub>2</sub>CO<sub>3</sub>·10H<sub>2</sub>O (washing soda). You have seen above that sodium carbonate can be obtained by heating baking soda; recrystallisation of sodium carbonate gives washing soda. It is also a basic salt.





B. Comment on the following statements:

- (i) Bee sting is treated with baking soda paste whereas wasp sting is treated with dilute vinegar.
- (ii) Farmers treat soil with quicklime when tilling.
- (iii) Ancient sculptures and marble structures are conserved by treating them with certain chemicals."

- (i) As bee sting is acidic and wasp sting is basic. (1)
- (ii) To change the nature of soil to (neutral or basic). (1)
- (iii) To protect sculptures from the effects of certain gases present in environment and acid rain. (1)

bee

vs.

wasp



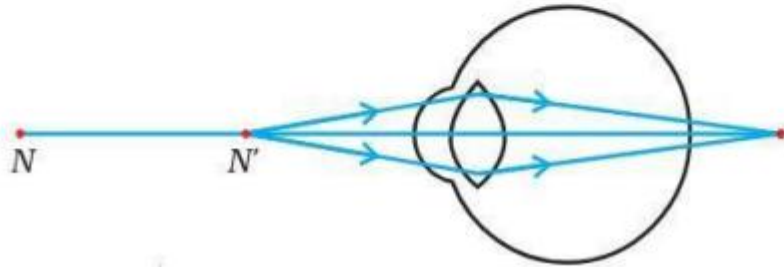
29 | Water is used by the leaves of the plants for photosynthesis but rather than watering the leaves, we water the plant through the soil. How does this water reach the leaves of the plant?

- In plants, the water is absorbed by the plants from the soil through the roots. Xylem tissue of the roots, stems and leaves are interconnected to form a continuous system of water conducting channels. (1)
- During the day, when stomata are open, the transpiration pull becomes the major driving force for the movement of water in the xylem. (1)
- Evaporation of water molecules from the stomata creates a suction which pulls water from the xylem cells of roots to the stem and then to the leaves. (1)

- 30
- A. In a family of four individuals, the father possessed long ears and the mother possessed short ears. If the parents had pure dominant and recessive traits respectively, then calculate the ratio of genetic makeup of F2 generation. Show a suitable cross. (2)
- B. If father had short ears and the mother had long ears, explain what effect it will have on the ratio of genetic makeup in F2 generation. (1)

- 30 (Any letter which clearly indicated dominant and recessive ears, example, L or E or any other)
- A.  $LL \times ll$   
F1 = Ll  
Ll X Ll  
1LL:2Ll:1ll. (2)
- B. No change in ratio/the ratio of F2 generation will still be 1LL:2Ll:1ll/ ratio will be the same.  
As the cross is still between a pure dominant and recessive allele/ genes/ traits/characters /as shown in the cross above. (1)

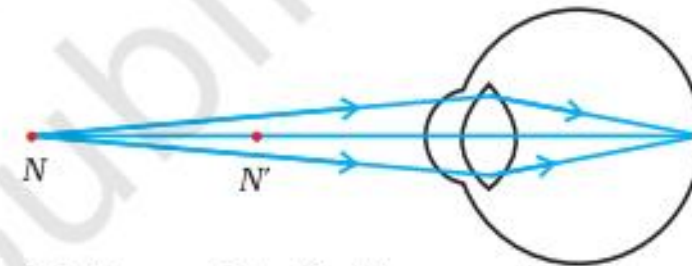
- A. What is the fundamental difference between hypermetropia and myopia in terms of the optical experience of a person?
- B. The diagram below shows a special case of an eye defect.
- What is the defect that is shown in the figure?
  - State one cause for such a defect?
  - Explain with reason if a concave lens can be used to correct the defect.



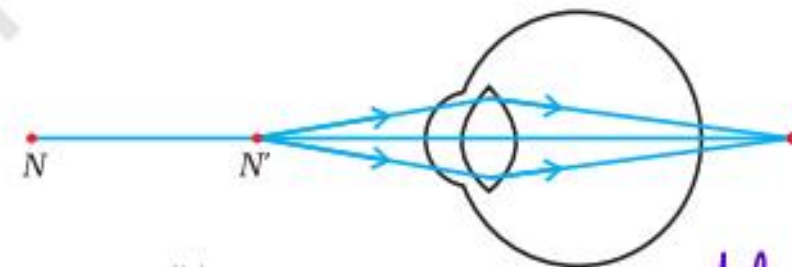
- A. Hypermetropia is a defect that causes difficulty in focusing on near objects, with clearer vision observed for distant objects. In Myopia distant objects appear blurry while near objects are seen clearly. (1)
- B.
- The image shows a case of hypermetropia. (0.5)
  - shortening of the eyeball or focal length of the eye lens becomes too long. (0.5)
  - No the concave lens would diverge the rays coming to the eyeball and will push the image even further, but a convex lens should be used which will help to converge the rays and create the image at the exact place on the retina. (1)

(b) **Hypermetropia**

Hypermetropia is also known as far-sightedness. A person with hypermetropia can see distant objects clearly but cannot see nearby objects distinctly. The near point, for the person, is farther away from the normal near point (25 cm). Such a person has to keep a reading material much beyond 25 cm from the eye for comfortable reading. This is because the light rays from a closeby object are focussed at a point behind the retina as shown in Fig. 10.3 (b). This defect arises either because (i) the focal length of the eye lens is too long, or (ii) the eyeball has become too small. This defect can be corrected by using a convex lens of appropriate power. This is illustrated in Fig. 10.3 (c). Eye-glasses with converging lenses provide the additional focussing power required for forming the image on the retina.

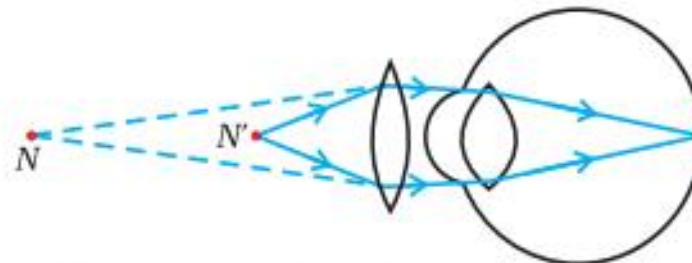


(a) Near point of a Hypermetropic eye



(b) Hypermetropic eye

defective eye



(c) Correction for Hypermetropic eye

corrected eye

- 32 | A. State the relationship between the resistance R of a wire to its length l and cross sectional area A. Use the mathematical symbols to arrive at the final formula.  
B. Using the formula define the resistivity of a material.

| 3

32

A.

$$R \propto l$$

$$R \propto \frac{l}{A}$$

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

(1.5)

B.

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

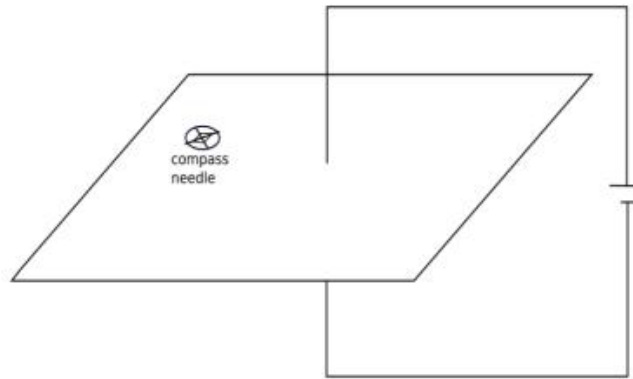
$$\rho = R \frac{A}{l} \text{ for } A = 1\text{m}^2 \text{ and } l = 1\text{m, we have}$$

$$\rho = R$$

Hence resistivity is the resistance offered by a wire of length 1 m having a cross sectional area of 1 m<sup>2</sup>.

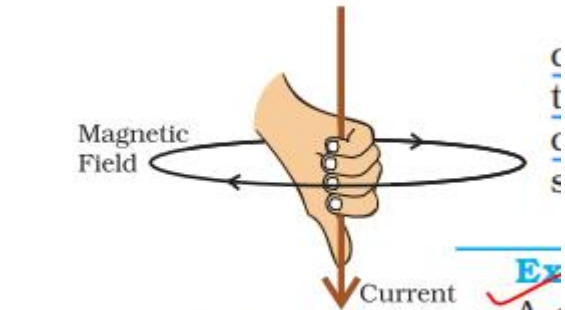
(1.5)

| 3



Mona was doing an experiment with a magnetic compass and a straight current-carrying wire. She observed that as she moved the compass away from the current-carrying wire, the deflection of the compass needle reduced.

- Explain why the deflection of the compass needle reduced as Mona moved away the compass needle from the current carrying wire.
- Mention one thing that could have changed in the circuit of the wire that could increase the deflection of the needle.
- Explain with reason what will be the direction of the magnetic field associated with the wire for the case described by the above figure.



**Figure 12.7**

*Right-hand thumb rule*

Ex  
A  
dir  
bel

- Magnetic field strength is inversely proportional to the distance from the current carrying wire. Hence when Mona moved the compass away from the current carrying wire, the magnetic effect was less on it and hence the deflection was less. (1)
- Magnetic field strength is directly proportional to the current in the wire. So, Mona could increase the current in the circuit to observe a greater deflection in the compass needle. (1)
- The battery suggests that the current is going from top of the plane to the bottom of the plane. Using the right hand thumb rule we can say that the magnetic field will be clockwise. (1)



### Section-D

Question No. 34 to 36 are long answer questions.

34

Attempt either option A or B.

5

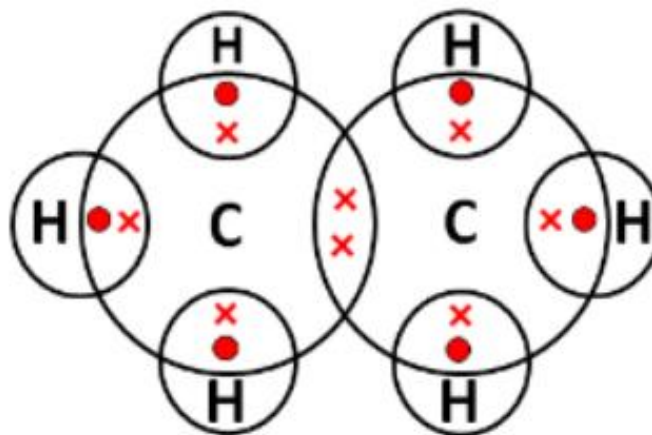
A.

- (i) "Keerthi thinks that Substitution reaction occurs in saturated Hydrocarbons, on the contrary Krishi thinks, it occurs in unsaturated Hydrocarbons." Justify with valid reasoning whose thinking is correct.
- (ii) "Methane and Propane and their Isomers are used as fuels" Comment. Draw the electron dot structure of the immediate lower homologue of Propane. Give any two characteristics of homologues of a given homologous series.
- (iii) A mixture of oxygen and ethyne is burnt for welding. Can you predict why a mixture of ethyne and air is not used?

A.

- (i) Keerthi's thinking is correct as substitution reactions occur in saturated hydrocarbons, hydrogen atoms are replaced with heteroatoms in saturated hydrocarbons. Whereas in unsaturated hydrocarbons an addition reaction occurs, simple molecules are added across double and/or triple bonds. (1)
- (ii) Methane and propane undergo combustion reaction in presence of oxygen and produce large amount of energy. (1)

The lower homologue of propane is ethane has the following electron dot structure:



(1)

ANY TWO CHARACTERISTICS

- Difference in  $-CH_2-$  / 14u molecular mass of any two adjacent homologues.
- Same general formula/ functional group
- Similar chemical properties
- Gradual change in physical properties (1)

- (iii) The mixture of ethyne and oxygen in sufficient amounts undergoes complete combustion to fire a clean blue flame. In pressure of insufficient supply of oxygen or in presence of air, ethyne does not undergo complete combustion and produces sooty flame. (1)

### 4.3.3 Addition Reaction

Unsaturated hydrocarbons add hydrogen in the presence of catalysts such as palladium or nickel to give saturated hydrocarbons. Catalysts are substances that cause a reaction to occur or proceed at a different rate without the reaction itself being affected. This reaction is commonly used in the hydrogenation of vegetable oils using a nickel catalyst. Vegetable oils generally have long unsaturated carbon chains while animal fats have saturated carbon chains.

Industrial Application



You must have seen advertisements stating that some vegetable oils are 'healthy'. Animal fats generally contain saturated fatty acids which are said to be harmful for health. Oils containing unsaturated fatty acids should be chosen for cooking.

The addition of hydrogen to an unsaturated hydrocarbon to get a saturated hydrocarbon in presence of nickel or palladium as catalyst is called hydrogenation.

### 4.3.4 Substitution Reaction

Saturated hydrocarbons are fairly unreactive and are inert in the presence of most reagents. However, in the presence of sunlight, chlorine is added to hydrocarbons in a very fast reaction. Chlorine can replace the hydrogen atoms one by one. It is called a substitution reaction because one type of atom or a group of atoms takes the place of another. A number of products are usually formed with the higher homologues of alkanes.



Saturated hydrocarbons will generally give a clean flame while unsaturated carbon compounds will give a yellow flame with lots of black smoke. This results in a sooty deposit on the metal plate in Activity 4.3. However, limiting the supply of air results in incomplete combustion of even saturated hydrocarbons giving a sooty flame. The gas/kerosene stove used at home has inlets for air so that a sufficiently oxygen-rich

mixture is burnt to give a clean blue flame. If you observe the bottoms of cooking vessels getting blackened, it means that the air holes are blocked and fuel is getting wasted. Fuels such as coal and petroleum have some amount of nitrogen and sulphur in them. Their combustion results in the formation of oxides of sulphur and nitrogen which are major pollutants in the environment.

#### **Why do substances burn with or without a flame?**

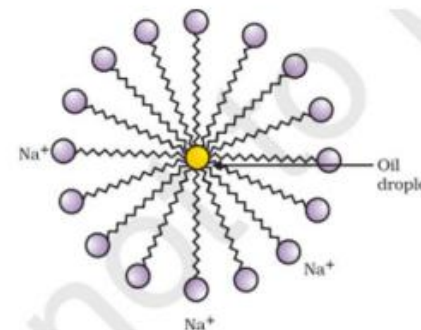
Have you ever observed either a coal or a wood fire? If not, the next time you get a

B.

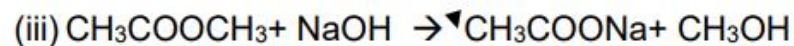
- (i) 'A' & 'B' are sodium salts of long-chain carboxylic acid and long chain Sulphonic acid respectively. Which one of A or B will you prefer as a cleansing agent while using underground water (hand pump water)? Give the reason for your answer.
- (ii) Elaborate on the process of cleansing action. Illustrate micelle with the help of labelled diagram.
- (iii) Write the chemical equation of the preparation of soap from an ester  $\text{CH}_3\text{COOCH}_3$ . What is the name of this process?

B.

- (i) 'B' is preferred for cleansing action. The calcium and magnesium salts present in underground water are precipitated with carboxylic acids. The  $\text{Ca}^{++}$  and  $\text{Mg}^{++}$  salts of sulphonic acid are soluble in water. 'B' is a more effective cleansing agent in presence of Ca and Mg salts. (1)
- (ii)
- Soaps are molecules in which the two ends have differing properties, one is hydrophilic, that is, it dissolves in water, while the other end is hydrophobic, that is, it dissolves in hydrocarbons.
  - The molecules of soap are sodium or potassium salts of long-chain carboxylic acids. The ionic end of soap dissolves in water while the carbon chain dissolves in oil. The soap molecules, thus form structures called micelles where one end of the molecules is towards the oil droplet while the ionic end faces outside. This forms an emulsion in water. The soap micelle thus helps in dissolving the dirt in water and we can wash our clothes clean



(Labelled fig - 1 + 2)



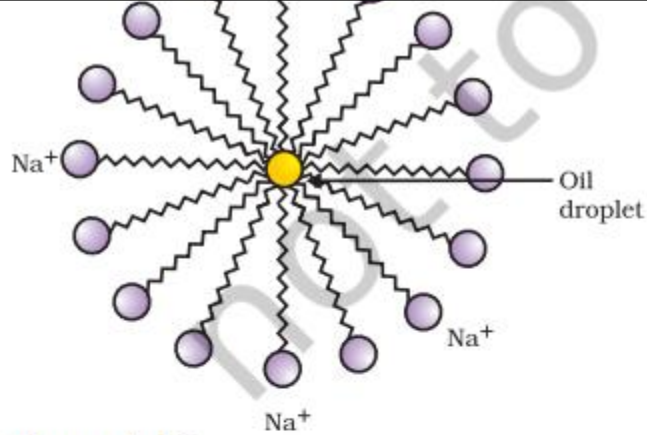
The process is saponification.

(0.5 + 0.5)

---

Have you ever observed while bathing that foam is formed with difficulty and an insoluble substance (scum) remains after washing with water? This is caused by the reaction of soap with the calcium and magnesium salts, which cause the hardness of water. Hence you need to use a larger amount of soap. This problem is overcome by using another class of compounds called detergents as cleansing agents. Detergents are generally sodium salts of sulphonic acids or ammonium salts with chlorides or bromides ions, etc. Both have long hydrocarbon chain. The charged ends of these compounds do not form insoluble precipitates with the calcium and magnesium ions in hard water. Thus, they remain effective in hard water. Detergents are usually used to make shampoos and products for cleaning clothes.

Q U E S T I O N S



**Figure 4.12**  
Formation of micelles

- Activity 4.10**
- Take about 10 mL of water each in two test tubes.
  - Add a drop of oil (cooking oil) to both the test tubes and label them as A and B.
  - To test tube B, add a few drops of soap solution.
  - Now shake both the test tubes vigorously for the same period of time.
  - Can you see the oil and water layers separately in both the test tubes immediately after you stop shaking them?
  - Leave the test tubes undisturbed for some time and observe. Does the oil layer separate out? In which test tube does this happen first?

This activity demonstrates the effect of soap in cleaning. Most dirt is oily in nature and as you know, oil does not dissolve in water. The molecules of soap are sodium or potassium salts of long-chain carboxylic acids. The ionic-end of soap interacts with water while the carbon chain interacts with oil. The soap molecules, thus form structures called micelles (see Fig. 4.12) where one end of the molecules is towards the oil droplet while the ionic-end faces outside. This forms an emulsion in water. The soap micelle thus helps in pulling out the dirt in water and we can wash our clothes clean (Fig. 4.13).

Attempt either option A or B.

- A. The image below shows a banana plant which is growing with the help of suckers. These suckers are small plant stem outgrowths which can be separated from the main plant and planted separately and they will grow into a new plant subsequently.

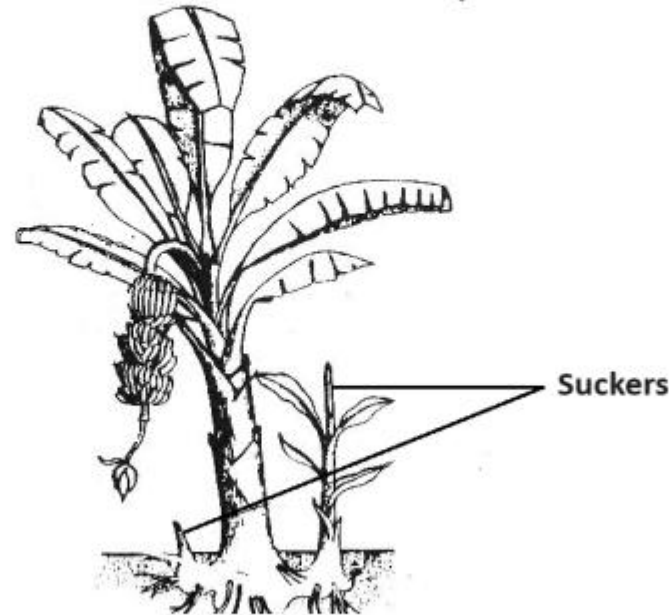


Fig.-1-Parts-of-Banana-plant-FAO-2021.png (623×609) (wp.com)

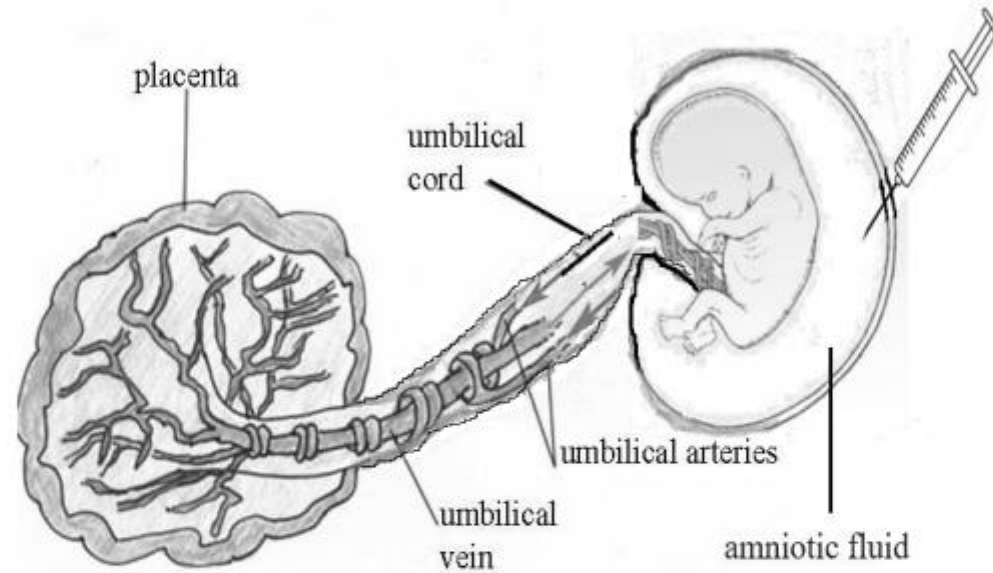
- (i) Give the name and type of reproduction that is shown in the image above. (1)
- (ii) List two advantages the farmer will have on using the type of reproduction mentioned above. (2)
- (iii) The above plant produces male flowers. Explain how this plant will be involved in the process of pollination. (1)
- (iv) Why is the offspring of this banana plant not absolutely identical to its parent plant? (1)



- (i) Vegetative propagation/ asexual reproduction. (0.5+0.5)
- (ii) More crops in same time interval, genetically identical, flower fruit faster, no need to depend on pollinators. (1+1)
- (iii) Cross pollination, the pollen from anther will be transferred the stigma of another banana plant using agents like wind, water, or insects etc. (0.5+0.5)
- (iv) There would be minor changes/some variation during the process of copying of the DNA. (1)

OR

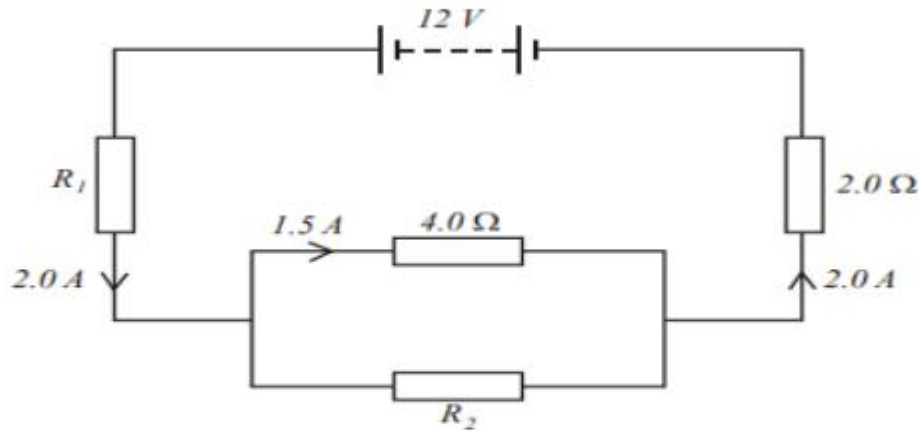
- B. The image below shows a developing fetus in the mother's womb. The developing fetus is connected to the placenta by means of umbilical cord. The Umbilical vein and artery run inside the umbilical cord.



- (i) Name two substance that moves through the blood vessels. (1)
- (ii) If the placenta has less villi how will it affect the baby's growth? (1)
- (iii) Name the region where the embryo develops inside the female body. Explain how this region is adapted for nourishing the baby. (1)
- (iv) Some of the fetal cells fall off into the amniotic fluid and can be collected by careful procedure. The cells were screened and found to contain XY chromosome. (2)
  - a) What is the sex of the foetus?
  - b) How is this prenatal sex determination misused?

- (i) Nutrients /glucose/oxygen/ waste. (any two) (1)
- (ii) less surface area for nutrients (glucose/oxygen) to pass from mother to embryo slow growth. (1)
- (iii) uterus; has thick lining with rich supply of blood to nourish the embryo. (1)
- (iv)
  - a) male child
  - b) misused as if the foetus is female, some people engage in aborting the child leading to female foeticide. (2)

A.



The above circuit is a part of an electrical device. Use the information given in the question to calculate the following.

- (i) Potential Difference across  $R_2$ .
- (ii) Value of the resistance  $R_2$ .
- (iii) Value of resistance  $R_1$

A.

(i) p.d. across  $4 \Omega$  resistor = p.d. Across  $R_2$  as both are in parallel.

(0.5)

$$1.5(A) \times 4 (\Omega) = 6 V \quad (0.5)$$

(ii) Total Current through  $4 \Omega$  and  $R_2 = 2.0 A$  (given).

Current through  $4 \Omega = 1.5 A$  (given) (0.5)

Hence current through  $R_2 = 2 - 1.5 = 0.5 A$

Using Ohm's law for  $R_2$  we get (0.5)

$$6 V = 0.5 A \times R_2$$

$$\text{Hence } R_2 = 6/0.5 = 12 \Omega \quad (0.5)$$

(iii) p.d. across  $R_1 = \text{Total p.d.} - (\text{p.d. across } R_2) - (\text{p.d. across } 2.0 \Omega)$  (0.5)

$$\text{p.d. across } 2.0 \Omega = 2 \times 2 = 4 V$$

$$\text{p.d. across } R_2 = 6 V \text{ (calculated before)} \quad (0.5)$$

$$\text{Hence p.d. across } R_1 = 12 - 6 - 4 = 2 V \quad (0.5)$$

$$\text{Current through } R_1 = 2 A \quad (0.5)$$

Using Ohm's Law, we get

$$R_1 = 2V/2A = 1 \Omega \quad (0.5)$$

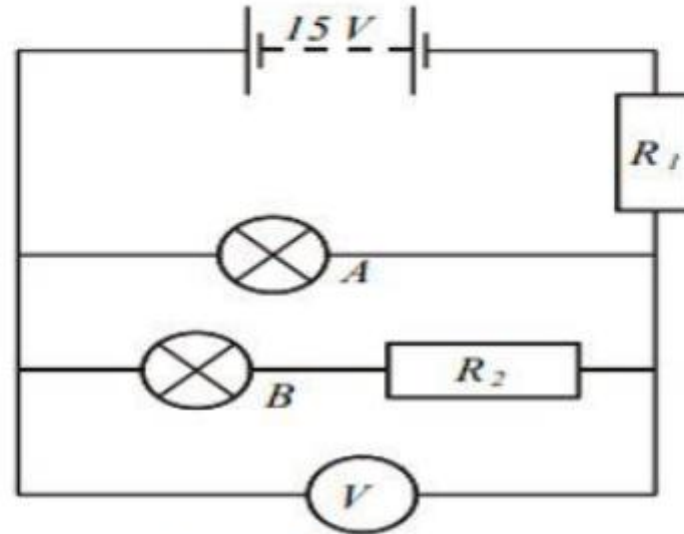
#### Alternative method

$$\text{Total Resistance} = R_1 + \frac{(4 \times 12)}{(4+12)} + 2 = 12V/2 A = 6 \Omega \quad (0.5)$$

$$R_1 = 6 - (3 + 2) = 1 \Omega \quad (0.5)$$

OR

B.



As shown in the figure above A and B are two lamps. Lamp A is rated at 12 V, 24W. Lamp B is rated at 6.0 V. When lamp B operates at its rated voltage, the current in it is 3.0 A. The values of  $R_1$  and  $R_2$  are chosen so that both lamps operate at their rated voltages.

Based on the information given, answer the following.

- (i) Calculate the current in Lamp A.
- (ii) State and give reason for the reading of the Voltmeter.
- (iii) Calculate the resistance of  $R_2$ .
- (iv) Find the value of the resistance  $R_1$ .

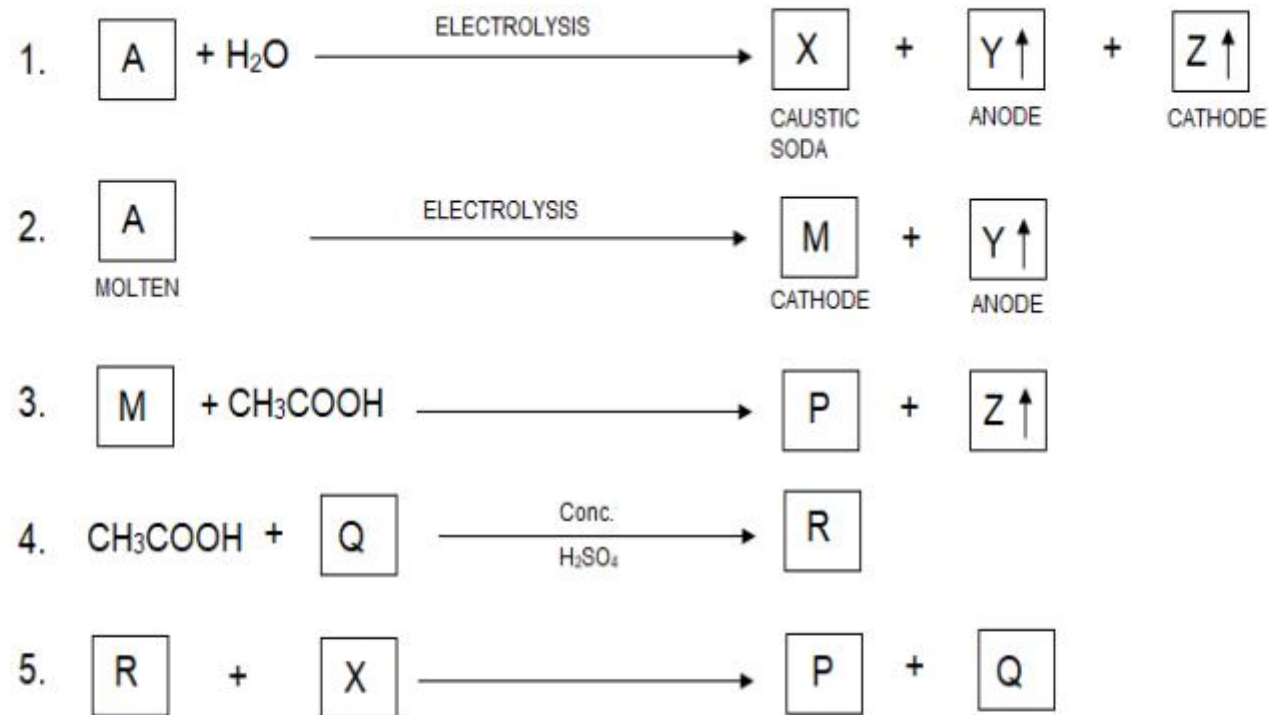
B.

- (i) Use of  $P = IV$  (0.5)  
 $I = P \div V = 24 \text{ W} \div 12\text{V}$   
Current in lamp A – 2 A (0.5)
- (ii) Voltmeter reading = 12 V (0.5)  
Lamp A and Lamp B are in parallel.  
Hence p.d. across the arm containing A = p.d. across arm containing B  
= 12 V (from a) (0.5)
- (iii) p.d. across  $R_2$  + p.d. across B = 12 V. (0.5)  
p.d. across B = 6 V (given)  
Hence p.d. across  $R_2 = 12 \text{ V} - 6 \text{ V} = 6\text{V}$  (0.5)  
  
Current through  $R_2 =$  Current through B = 3A (given) (0.5)  
Use of  $R = V/I$   
 $R_2 = 6\text{V}/3\text{A} = 2\Omega$  (0.5)
- (iv) Current through  $R_1 =$  Total Current = 3A+2A = 5A (0.5)  
p.d. across  $R_1 = 15\text{V} - 12 \text{ V} = 3\text{V}$   
 $R_1 = 3\text{V}/5\text{A} = 0.6 \Omega$  (0.5)

## Section – E

Question No. 37 to 39 are case-based/data -based questions.

37



4

A. Derive the names of A, Y, Z, M, P & R

Attempt either subpart B or C.

B. Improvise an activity to test Z.

**OR**

C. Name the process in which compounds X, Y & Z are formed from A.  
 Justify your response.



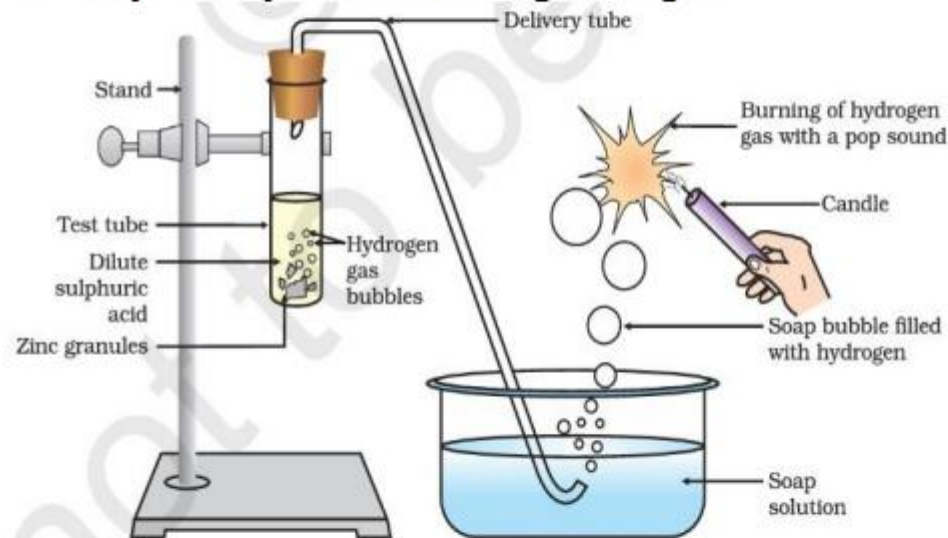
- A. A - Sodium chloride  
Y - Chlorine gas,  
Z - Hydrogen gas,  
M - Sodium metal,  
P - Sodium ethanoate &  
R - Ethyl ethanoate/ester

(0.5 X 6 = 3)

Student to attempt either subpart B or C.

- B. Any activity similar to the given figure

(1)



**Figure 2.1** Reaction of zinc granules with dilute sulphuric acid and testing hydrogen gas by burning

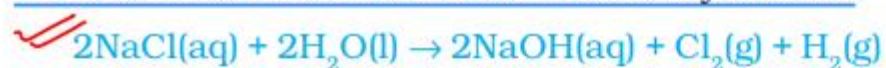
**OR**

- C. Chlor alkali process

The process is called the chlor-alkali process because of the products formed from chlorine and alkali for sodium hydroxide. (1)

### Sodium hydroxide

When electricity is passed through an aqueous solution of sodium chloride (called **brine**), it decomposes to form sodium hydroxide. The process is called the **chlor-alkali process** because of the products formed—chlor for chlorine and alkali for sodium hydroxide.

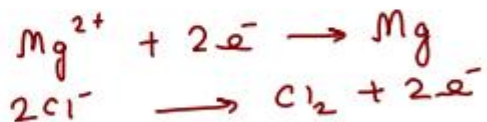


Chlorine gas is given off at the anode, and hydrogen gas at the cathode. Sodium hydroxide solution is formed near the cathode. The three products produced in this process are all useful. Figure 2.8 shows the different uses of these products.

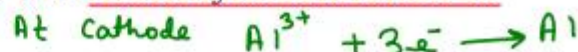


### 3.4.5 Extracting Metals towards the Top of the Activity Series

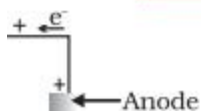
The metals high up in the reactivity series are very reactive. They cannot be obtained from their compounds by heating with carbon. For example, carbon cannot reduce the oxides of sodium, magnesium, calcium, aluminium, etc., to the respective metals. This is because these metals have more affinity for oxygen than carbon. These metals are obtained by **electrolytic reduction**. For example, **sodium, magnesium and calcium** are obtained by the electrolysis of their molten chlorides. The metals are deposited at the cathode (the negatively charged electrode), whereas, chlorine is liberated at the anode (the positively charged electrode). The reactions are –



Similarly, **aluminium** is obtained by the electrolytic reduction of aluminium oxide.

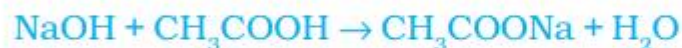


### 3.4.6 Refining of Metals





- (ii) **Reaction with a base:** Like mineral acids, ethanoic acid reacts with a base such as sodium hydroxide to give a salt (sodium ethanoate or commonly called sodium acetate) and water:



**How does ethanoic acid react with carbonates and hydrogencarbonates?**

Let us perform an activity to find out.

## Activity 4.9

Set up the apparatus as shown in Chapter 2, Activity 2.5.

Take a spatula full of sodium carbonate in a test tube and add 2 mL of dilute

### Reactions of ethanoic acid:

- (i) **Esterification reaction:** Esters are most commonly formed by reaction of an acid and an alcohol. Ethanoic acid reacts with absolute ethanol in the presence of an acid catalyst to give an ester –



Generally, esters are sweet-smelling substances. These are used in making perfumes and as flavouring agents. On treating with sodium hydroxide, which is an alkali, the ester is converted back to alcohol and sodium salt of carboxylic acid. This reaction is known as saponification because it is used in the preparation of soap. Soaps are sodium or potassium salts of long chain carboxylic acid.



**Figure 4.11**  
Formation of ester

Mohan and Rohit observed that shoots of a plant growing in shade bend towards the sunlight. Whereas, leaves of 'Touch me not' plant fold and droop soon after touching. They were curious to know how these movements occur in plants.



A. Shoots of a plant bending towards light



B. Folding of leaves Touch me not plant

In order to help them understand the movements in the plants, answer the following questions:

Attempt either subpart A or B.

A. What causes the bending of shoots in the plants as shown in figure A?

**OR**

B. What causes the folding of the leaves in 'Touch me not' plant as shown in figure B? (2)

C. Compare the movement of growth of the pollen tube towards ovule with the movements shown in part A of the above figure. (1)

D. Compare the movement shown in figure B with the movement of body parts in the animals. (1)

A.

- Bending of shoots of plants is a response to the stimulus and a directional, growth-related movement.
- When growing plants detect sunlight, a hormone called auxin, synthesized at shoot tip helps the cells to grow longer.
- When light is coming from one side of the plant, auxin diffuses to the shady side of the shoot.
- This concentration of auxin stimulates the cells of the shoot to grow longer on the side of the shoot which is away from the light. Thus, plant appears to bend towards light. (0.5 x 4 =2)

**OR**

B.

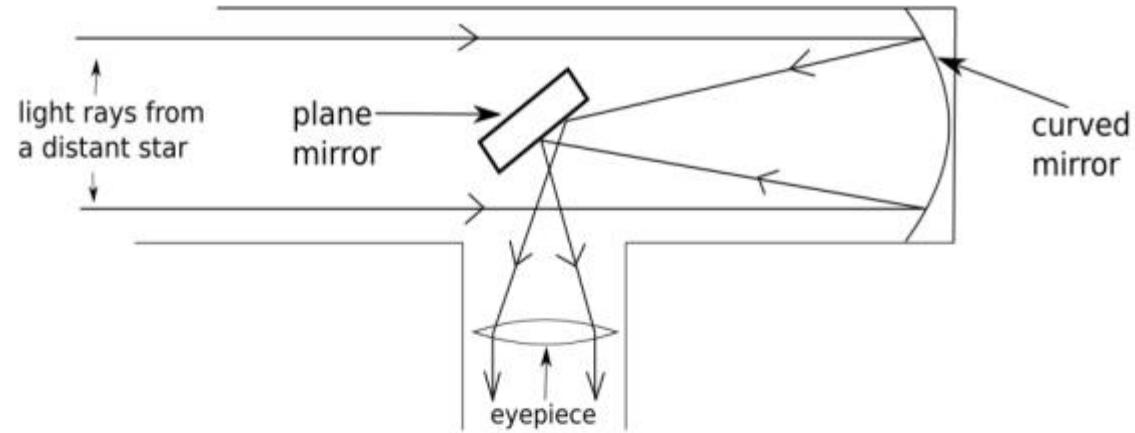
- Leaves of 'Touch me not' plant respond to the stimulus by showing growth independent movement.
- These plants use electrical–chemical means to convey the information from cell to cell.
- Movement happens at a point different from the point of touch.
- Plant cells change shape by changing the amount of water in them, resulting in swelling or shrinking, and therefore in changing shape.

(0.5 x 4 =2)

C. Growth of pollen tubes towards the ovule is an example of chemotropism whereas bending of shoots towards sunlight is an example of phototropism. (1)

D.

- i) Although both plants and animals show electrical–chemical means to convey the information from cell to cell but unlike nerve cells in animals there is no specialized tissue in plants for conduction of information. (0.5)
- ii) In animal cells, change in shape occurs because of the specialized proteins found in muscle cells; plant cells change shape by changing the amount of water in them. (0.5)



The above image is that of a reflecting telescope. Reflecting telescopes revolutionised our ways of looking into the sky. They employ mirrors to gather and focus light, rather than relying solely on lenses as in their refracting counterparts. These telescopes utilise precisely shaped and polished mirrors to capture incoming light and reflect it to a focal point, where it forms an image for observation.

- A. What kind of image of the star is seen by the observer at the eyepiece?
- B. What kind of mirror is used in this reflecting telescope?

Attempt either subpart C or D.

- C. Explain with reason what kind of optical device (type of lens or mirror) that is used at the eyepiece.

**OR**

- D. What is the role of the plane mirror in the telescope?

A. Real Image (the final image is formed due to the lens at the eye-piece)  
(1)

B. Concave Mirror (1)

Student to attempt either subpart C or D.

C. A converging lens is used at the eyepiece to collect the rays from the plane mirror and help the viewer to see a real erect image of the star.  
(2)

**OR**

D. The plane mirror laterally inverts the image formed by the curved mirror and its position helps to direct the rays towards the eye-piece.  
(2)







