CBSE
Class X Science

Time: 3 hrs **Total Marks: 80**

General Instructions:

1. The question paper comprises of two **Sections, A** and **B**. You are to attempt both the sections.
2. All questions are compulsory.
3. All questions of **Section A** and **Section B** are to be attempted separately.
4. There is an internal choice in **three** questions of **three** marks each, **two** questions of **five** marks each in Section A and in **one** question of **two** marks in Section B.
5. Question numbers **1** and **2** in **Section A** are **one mark** questions. These are to be answered in one word or in **one** sentence.
6. Question numbers **3** to **5** in **Section A** are **two marks** questions. These are to be answered in about **30 words each**.
7. Question numbers **6** to **15** in **Section A** are **three marks** questions. These are to be answered in about **50 words each**.
8. Question numbers **16** to **21** in **Section A** are **five marks** questions. These are to be answered in about **70 words each**.
9. Question numbers **22** to **27** in **Section B** are based on practical skills. Each question is a **two** marks question. These are to be answered in brief.

SECTION A

1. What is meant by translocation with respect to transport in plants? (1)

2. Name any two elements present in fossil fuels in addition to carbon. (1)

3. Electrical resistivity of silver is $1{\cdot}60 \times 10^{-6}$ Ωm. What will be the resistance of a silver wire of length 10 m and cross-sectional area 2×10^{-3} m^2? (2)

4. A brown substance 'X' on heating in air forms a compound 'Y'. When hydrogen gas is passed over 'Y', it changes to 'X' again. (2)
(i) Name substances 'X' and 'Y'.
(ii) Name the processes occurring during the two changes.

5. Describe how decomposers facilitate recycling of matter in order to maintain balance in the ecosystem. (2)

6. What is a reflex action? Describe the steps involved in a reflex action. (3)

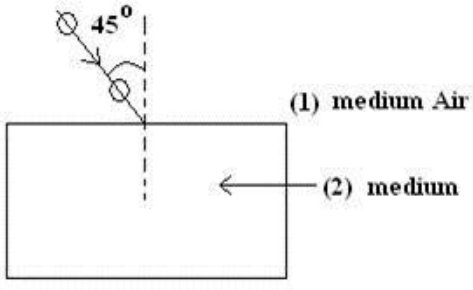
7. Explain natural selection with the help of suitable examples. (3)

OR

Distinguish between biodegradable and non-biodegradable substances. List two effects of each of them on our environment.

8. A student wants to obtain an erect image of an object using a concave mirror of 12 cm focal length. What should be the range of distance of the object from the mirror? State the nature and size of the image he is likely to observe. Draw a ray diagram to justify your answer. (3)

OR



A ray of light is incident at an angle of 45° at the interface of medium (1) and medium (2) as shown in the above diagram. Redraw this diagram in the answer book and complete it. If the angle of refraction is 30°, find the refractive index of medium (2) with respect to medium (1).

(Given that $\sin 45^0 = \frac{1}{\sqrt{2}}$ $\sin$ and $\sin 30^0 = \frac{1}{2}$)

If second medium is water in place of medium (2), will the angle of refraction increase or decrease? Why? (Refractive index of water =4/3)

9. Consider the following elements: Na, Ca, Al, K, Mg and Li. (3)

(a) Which of these elements belong to the 3rd period of the modern periodic table?

(b) Which of these elements belong to Group 1 of the modern periodic table?

(c) Which of these elements show a valency of +3?

10. Is it true that when a new species emerges, the old species is eliminated and why? (3)

11. What is organic evolution? How do embryological studies provide evidence for evolution? (3)

12. A water-insoluble calcium compound (A) on reacting with dil. H_2SO_4 released a colourless and odourless gas (B) with brisk effervescence. When this gas (B) was passed through lime water, the lime water turned milky and again formed compound A. Identify A and B, and write the chemical equations for the reactions involved. (3)

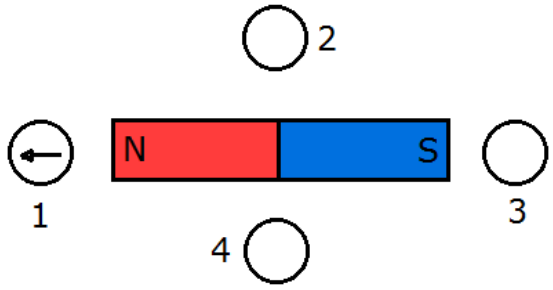
OR

(a) With the help of a suitable example, explain oxidation and reduction in terms of gain or loss of oxygen.

(b) Identify the substances which are oxidised and the substances which are reduced in the following reaction:

$$4Na_{(s)} + O_{2(g)} \longrightarrow 2Na_2O_{(s)}$$ (3)

13. The diagram below shows a bar magnet surrounded by 4 compasses. What directions will the compasses 2, 3 and 4 show? (3)



14. Ethanol is used on a large scale at a commercial level. It is commonly called alcohol and is an active ingredient of alcoholic drinks. Yet, consumption of alcohol also causes drunkenness and this practice is socially condemned. As a responsible student of Class X, what steps you would take to discourage the use of alcohol? (3)

15. Karan's school organised a picnic at a wildlife sanctuary. The students noticed a streak of bright light through the canopy of the dense forest. Karan went near the canopy and saw that a few people were cutting trees. Karan informed his teacher who then contacted the police. (3)

(a) What values were exhibited by Karan and his teacher?

(b) What is the phenomenon due to which bright light was seen through the canopy? Explain the phenomenon.

16. Explain with an example how Metal X which is low in reactivity series and Metal Y which is high in reactivity series are obtained from their compounds by the reduction process.

(a) Write the electronic configurations of sodium and chlorine. Show the formation of sodium chloride from sodium and chlorine by the transfer of electrons.

(b) List any two observations when a highly reactive metal is dropped in water. (5)

17. Explain the process of photosynthesis in plants. List four factors which influence this process and describe how each of them affects the rate of photosynthesis process. (5)

OR

(a) Write the three main steps which take place in chloroplasts during photosynthesis.

(b) How does stomata open and close?

(c) Which raw material is made available to plants for photosynthesis when stomata are open?

18. Draw a ray diagram for the following positions of the object placed in front of a convex lens: (5)

(i) Between optical centre and principal focus (F)

(ii) Between F and 2F

(iii) At 2F

How will the nature and position of the image formed change in cases (i) and (ii) in part (a) if the convex lens is replaced with a concave lens? Draw the corresponding ray diagram.

19. (5)

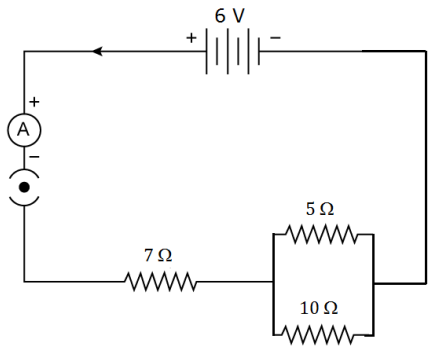
(a) Derive an expression for the heat produced in a conductor of resistance R when a current I flows through it for time t.

(b) Two identical resistors of resistance R are connected in series with a battery of potential difference V for time t. The resistors are then connected in parallel with the same battery for the same time t. Compare the heat produced in the two cases.

OR

(a) Deduce the expression for the equivalent resistance of the parallel combination of three resistors R_1, R_2 and R_3.

(b) Consider the following electric circuit:



Calculate:

(i) Resultant resistance

(ii) Total current

(iii) Voltage across 7-Ω resistor

20. (5)

(a) Why are covalent compounds generally poor conductors of electricity?

(b) Name the gas evolved when ethanoic acid is added to sodium carbonate. How would you prove the presence of this gas?

(c) Write the structural formula of two isomers of n-pentane C_5H_{12}.

21. (5)

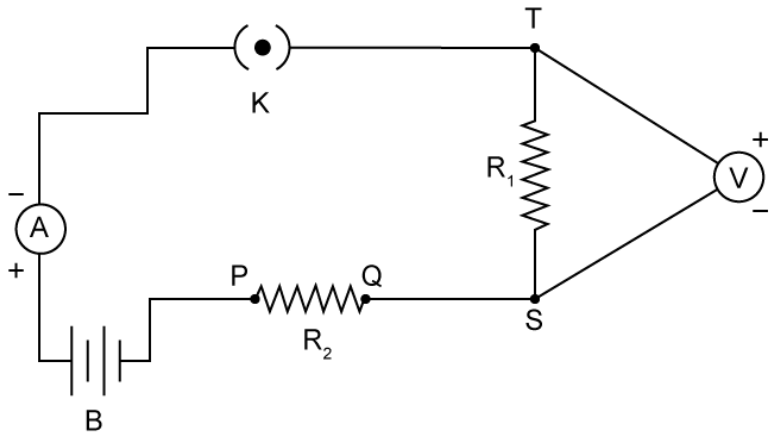
(a) Draw a diagram showing the germination of pollen on the stigma. Label the style, male germ cell, ovule and female germ cell.

(b) What happens to the following parts of a flower after fertilisation—Ovule, Zygote, Ovary?

SECTION B

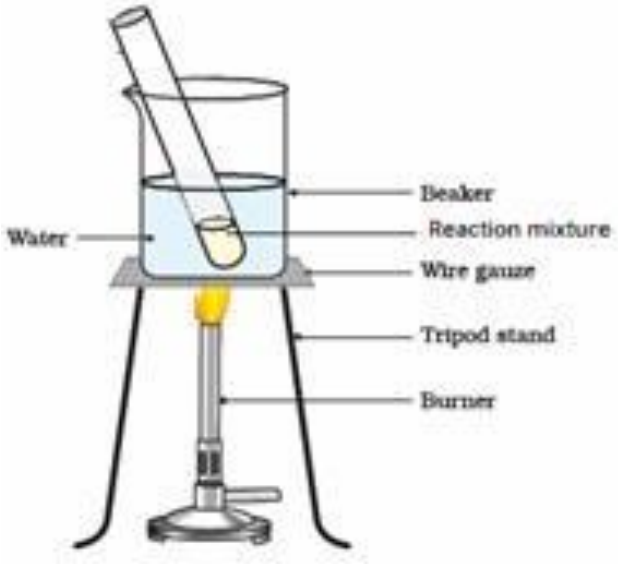
22. To prepare a good temporary mount of Petunia leaf peel showing many stomata, where will the student get the peel from? (2)

23. A student sets up a circuit for finding the equivalent resistance of a series combination of two resistors R_1 and R_2 as shown in her circuit diagram. She did not obtain the correct results in her experiment because of a mistake. Identify the mistake and state a measure to correct it. (2)



24. Two students perform an experiment with mirrors, one with a concave mirror and one with a convex mirror. The image formed by a concave mirror is real while that of the convex mirror is virtual. Where the screen should be placed in both cases? (2)

25. Ethanol is heated gently in a water bath as shown in the setup. When potassium permanganate is added in excess, the pink colour of potassium permanganate disappears due to the formation of which compound? Write the balanced chemical equation to support your answer. (2)



26. Equal lengths of Mg ribbon are taken in test tubes A and B. Hydrochloric acid is added to test tube A, while acetic acid is added to test tube B. In which case the reaction would occur more vigorously and why? Write the chemical equations for reactions in test tubes A and B. (2)

27. What are the precautions taken during the experimental setup in proving that carbon dioxide is given out during respiration? (2)

OR

A student wanted to conduct an experiment to show that CO_2 is released during respiration. List two precautions which he/she must take in order to get accurate results.

CBSE
Class X Science
Solution

SECTION A

1. Translocation is the movement of soluble materials such as minerals, proteins, hormones and sugars within the plant.

2. Hydrogen and sulphur are two elements present in fuels in addition to carbon.

3.

Resitivity of silver, $\rho = 1.6 \times 10^{-6}\ \Omega m$

Length of wire, $l = 10$ m

Cross-sectional area, $A = 2 \times 10^{-3}\ m^2$

Resistance is

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

$$\therefore R = \frac{1.6 \times 10^{-6} \times 10}{\left(2 \times 10^{-3}\right)^2} = 4\ \Omega$$

4.

(i) X: Copper (Cu)
Y: Copper oxide (CuO)

(ii) First: Oxidation of X; Second: Reduction of Y

5. Decomposers break complex organic substances into simple organic substances which go into the soil and are again taken up by plants by microorganisms. In this way, decomposers facilitate recycling of matter to maintain balance in the ecosystem.

6. A reflex action is an involuntary, automatic and nearly instantaneous response to a stimulus.

Steps involved in reflex action:

i. The sense organ (skin) is stimulated with a prick, and the stimulus is received by skin receptor cells.
ii. Sensory nerves send this impulse to the spinal cord.
iii. An association neuron transmits this impulse to the motor neuron.
iv. The motor neuron relays the impulse to the muscles of the effector organ (hand).

7. Natural selection is the process whereby organisms better adapted to their environment tend to survive and produce more offspring, whereas other less favourable traits tend to become eliminated. Continuous competition between individuals for environmental resources creates a 'struggle for existence and this struggle makes sure that certain organisms fail to survive or reproduce'.

Examples include

i. Galapagos finches all have different types of beaks. During drought, the finches with the larger beaks survived better than those with the smaller beaks. During rainy times, more small seeds were produced and the finches with smaller beaks fared better.

ii. A habitat has red bugs and green bugs. Birds prefer the taste of red bugs, so soon there are many green bugs and few red bugs. Green bugs reproduce and make more green bugs and eventually there are no more red bugs.

iii. In one ecosystem, lizards which had long legs could climb better to avoid floods and reach the food.

OR

Biodegradable substances: Substances which can be broken down by microorganisms such as bacteria and fungi are called biodegradable substances. Examples: Paper, vegetable and fruit peels, human excreta

Non-biodegradable substances: Substances which cannot be broken down by microorganisms into simpler and harmless substances are called non-biodegradable substance. Examples: Polythene bags, aluminium cans and DDT

Effects of biodegradable substances:

- They produce a foul smell causing air pollution. If thrown in water, they cause water pollution.
- They serve as a breeding ground for flies and mosquitoes which are carriers of malaria.

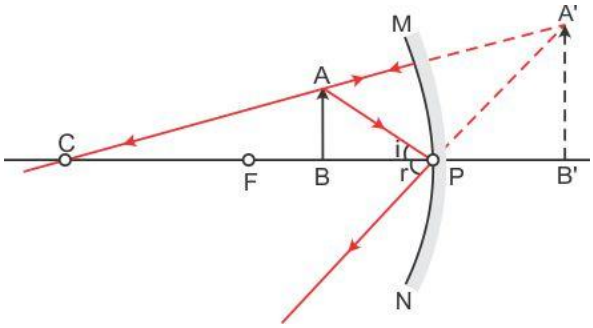
Effects of non-biodegradable substances:

- Non-biodegradable pesticides and fertilisers run off with rain water into water bodies and cause water pollution and affect the soil making it acidic or alkaline.
- Some non-biodegradable pesticides enter the food chain and badly affect humans and other organisms.

8. Focal length of the concave mirror f is –12 cm.

The student wants to obtain an erect image. A concave mirror produces an erect image when the object is between the pole and the focus. Hence, the range of the object distance should be 0–12 cm from the mirror.

The image so formed would be virtual, erect and magnified.



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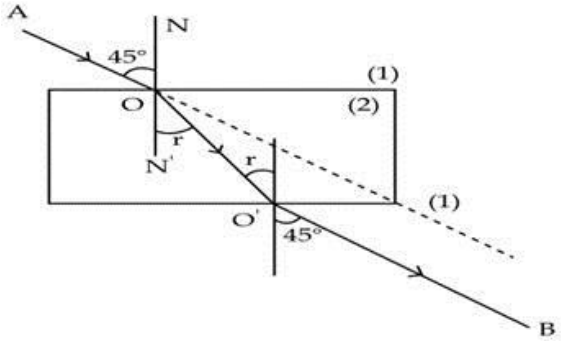


The refractive index of medium (2) with respect to medium (1) is given as,

Using Snell's law

$$n_{21} = \frac{\sin i}{\sin r} = \frac{\sin 45^0}{\sin 30^0} = \frac{1/\sqrt{2}}{1/2} = \sqrt{2} = 1.414$$

If second medium is water in place of medium (2), angle of refraction will decrease because water is rarer than medium (2).

9.

(a) Elements which belong to the 3rd period of the modern periodic table are Na, Mg and Al.

(b) Elements which belong to Group 1 of the modern periodic table are Li, Na and K.

(c) Al

10. No, it is not true that when a new species emerges, the old species is eliminated. Because when there is a change in any species, the change is only in a part or a few members of the species population. If the newly generated species after genetic change is better in any way, it will get more opportunity to survive; if the genetic change is against the environment, it will die. Thus, unchanged members of other species may also remain and tend to live in the changed environment.

11. Organic evolution occurs because of changes in a species which appear generation after generation and accumulate to form a new species.

The embryology of different vertebrates provides very strong evidence of different vertebrates which show striking similarities. There is an obvious similarity between embryos of fish, amphibians, reptiles, birds and mammals. A comparison of embryos of vertebrates shows that all have gill slits even though they do not remain later in life(except in fish). This indicates a fundamental step which is common to all vertebrates and supports the idea of a common ancestor. Other features which do not exist in the adult form but appear in the embryo include limb buds in dolphins and tail buds in humans.

This shows that species sharean ancestor, so their developmental processes occur similarly regardless of other changes which have occurred because of their divergence.

12. $CaCO_3$ + dil. $H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$

A B

$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

(Lime water) A

A: $CaCO_3$ (Limestone)

B: CO_2 (g)

OR

(a) Oxidation: Gain of oxygen by a substance.

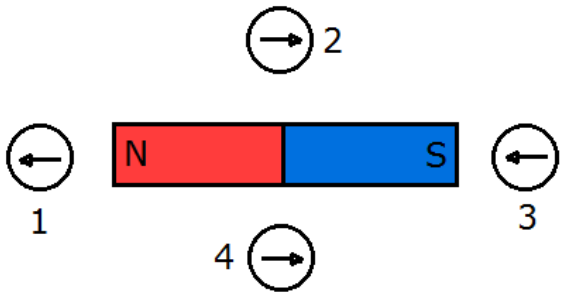
$2Cu + O_2 \xrightarrow{Heat} 2CuO$

Reduction: Loss of oxygen by a substance.

$CuO + H_2 \xrightarrow{Heat} Cu + H_2O$

(b) Sodium (Na) is oxidised to sodium oxide as it gains oxygen, and oxygen reduces.

13. Directions shown by the four needles would be



For a bar magnet, the field lines emanate from the North Pole and end at the South Pole. Hence, the field lines are directed towards the right for compasses 2 and 4 and towards the left for compass 3.

14. Steps to discourage the use of alcohol:

(a) By not getting attracted towards this habit, by stopping my friends as well and asking them to keep it in control if they do consume alcohol

(b) By making posters, banners and writing articles on this issue

(c) By sensitising people about the harmful effects of liquor consumption

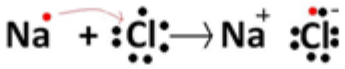
15.

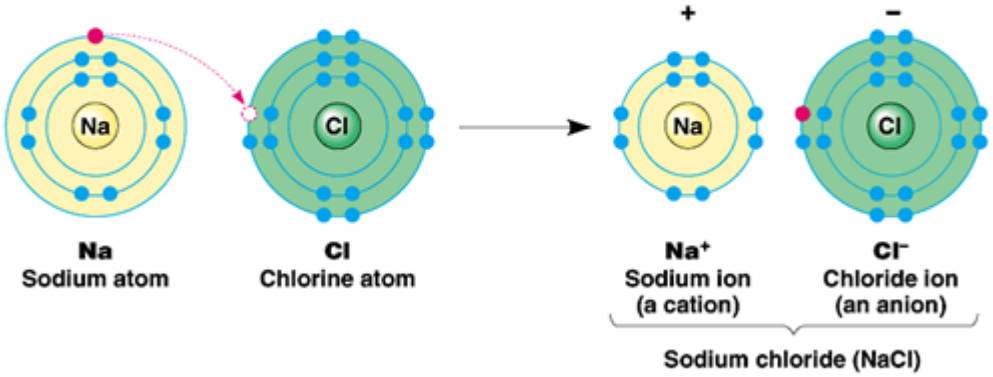
(a) Karan showed curiosity in knowing things and has a keen observing power. He showed the ability to judge quickly and was a law-abiding citizen.
Karan's teacher showed awareness and was also a law-abiding citizen.

(b) A streak of bright light through the canopy of the dense forest was seen due to the Tyndall effect. According to the Tyndall effect, when a beam of light strikes colloidal solution particles (fine particles), the path of the beam becomes visible.

16. Metals in the low reactivity series are obtained by heating their oxides alone.
Mercury is obtained by heating mercurous oxide. Metals high up in the reactivity series are obtained by electrolytic reduction. Sodium is obtained by the electrolysis of its molten chlorides.

(a) Electronic configuration of sodium (Na) = 2, 8, 1
Electronic configuration of chlorine (Cl) = 2, 8, 7
Formation of sodium chloride by the transfer of electrons





(b) (i) Highly exothermic; (ii) the metal starts floating

17. Photosynthesis occurs in two phases—light reaction and dark reaction.

Light Reaction:

This phase occurs in the thylakoids of the chloroplast. Various events occurring in photosynthesis:

- Absorption of light energy
- Splitting of water molecules into hydrogen and oxygen atoms
- Formation of ATP and $NADPH_2$

Dark Reaction:

This phase occurs simultaneously with the light-dependent reaction. In this phase, carbon dioxide is converted to glucose by using ATP and NADPH produced during the light reaction.

Factors which affect the rate of photosynthesis:

Light:

- Rate of photosynthesis increases when light gets brighter.
- Rate of photosynthesis increases linearly with increasing light intensity.

Carbon dioxide concentration:

- Increase in the concentration of carbon dioxide increases the rate of photosynthesis.
- Rate of photosynthesis increases linearly with increasing carbon dioxide concentration.
- Increased carbon dioxide concentration is beneficial for greenhouse crops such as tomatoes.

Temperature

- Higher the temperature, greater is the rate of photosynthesis.
- Rate of photosynthesis slows down when the temperature is more than 40°C because the enzymes involved in the chemical reactions of photosynthesis are temperature sensitive and are destroyed at higher temperatures.

Water

- Water stress causes leaves to wilt, thereby reducing their surface area and metabolic activity.

OR

(a) Steps which take place in chloroplasts during photosynthesis:

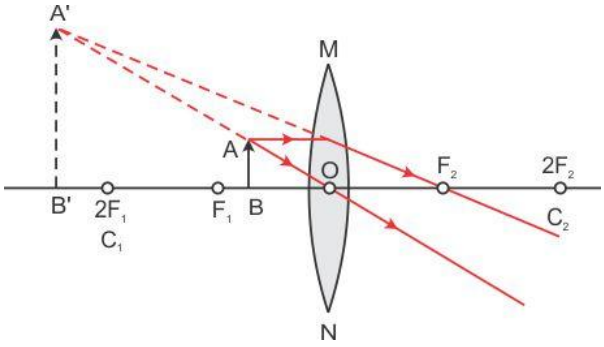
- Absorption of light energy by chlorophyll
- Conversion of light energy to chemical energy, and splitting of water into hydrogen and oxygen using light energy
- Reduction of carbon dioxide by hydrogen to form carbohydrate like glucose by utilising the chemical energy

(b) The opening and closing of stomata is controlled by guard cells. When water flows into the guard cells, they swell, become curved and cause the stomata to open. When the guard cells lose water, they shrink, become flaccid and straight, thus closing the stomata.

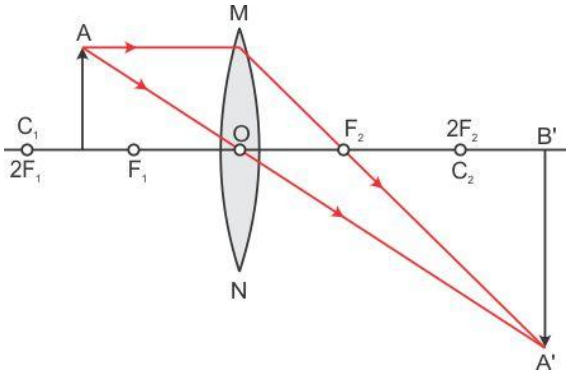
(c) Carbon dioxide is made available to plants when stomata are open.

18.

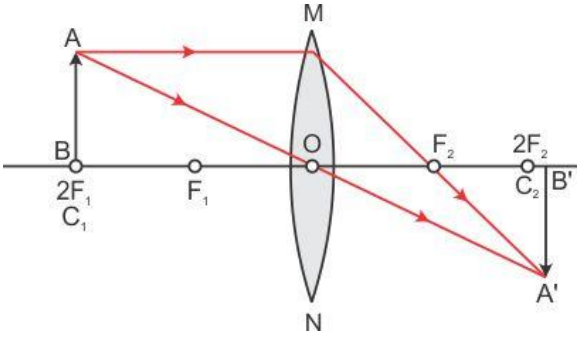
(i) Between optical centre and principal focus (F)



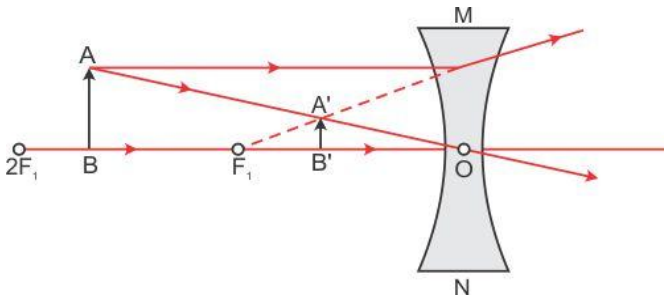
(ii) Between F and 2F



(iii) At 2F



For a concave lens, the image formed is virtual, erect and diminished for all distances between infinity and the optical centre. Hence, for cases (i) and (ii), the image will be virtual, erect and diminished.



CASE	CONVEX	CONCAVE
(i)	Virtual, erect and magnified	Virtual, erect and diminished
(ii)	Real, inverted and magnified	Virtual, erect and diminished

19.

(a) A conductor offers resistance to the flow of current. Hence, work must be done by the current continuously to keep itself flowing.

When an electric charge Q moves against a potential difference V, the work done isW = QV.

From the definition of current,

$$I = \frac{Q}{t}$$

$$\therefore Q = It$$

From Ohm's law,

$$V = IR$$

$$\therefore W = It \times IR = I^2Rt$$,

Assuming that all this work goes in producing heat energy.

Therefore, the heat produced in a conductor of resistance 'R' when current 'I' is flowing for time 't' is

$$H = I^2Rt$$

(b) When resistors are connected in series:

$$R_s = R + R = 2R$$

$$\therefore H_s = \frac{V^2}{R_s} = \frac{V^2}{2R} \quad \text{..... (1)}$$

When resistors are connected in parallel:

$$\frac{1}{R_p} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R}$$

$$\therefore R_p = \frac{R}{2}$$

$$\therefore H_p = \frac{V^2}{R_p} = \frac{2V^2}{R} \quad \text{..... (2)}$$

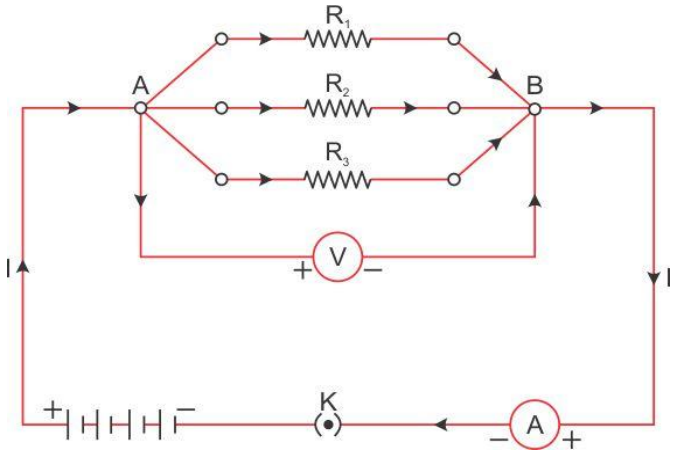
From (1) and (2),

$$\frac{H_s}{H_p} = \frac{V^2}{2R} \times \frac{R}{2V^2} = \frac{1}{4}$$

$$\therefore H_p = 4H_s$$

OR

(a) When two or more resistors are joined to the same end, the resistances are connected in parallel.



Potential difference in a parallel circuit remains the same across all resistors.

The current is the sum of the currents across all the individual resistors.

$$I = I_1 + I_2 + I_3 \qquad \text{..... (1)}$$

Let R_p be the resultant resistance of the circuit.

On applying Ohm's law to the entire circuit,

$$I = \frac{V}{R_p} \qquad \text{..... (2)}$$

Now, applying Ohm's law to individual resistances,

$$\left.\begin{aligned} I_1 &= \frac{V}{R_1} \\ I_2 &= \frac{V}{R_2} \\ I_3 &= \frac{V}{R_3} \end{aligned}\right\} (3)$$

From equations (1), (2) and (3),

$$\frac{V}{R_p} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\therefore \frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

(b) For the given circuit,

(i) The resultant resistance is

$$R_{eq} = 7 + 5 || 10$$

$$\therefore R_{eq} = 7 + \frac{10 \times 5}{10 + 5} = 7 + \frac{50}{15}$$

$$\therefore R_{eq} = \frac{105 + 50}{15} = \frac{155}{15} = 10.33\ \Omega$$

(ii) The total current is

$$I = \frac{V}{R_{eq}}$$

$$\therefore I = \frac{6}{10.33} = 0.58 \text{ A}$$

(iii) Voltage across the 7Ω resistor is

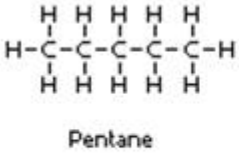
$$V_7 = IR_7 = 0.58 \times 7 = 4.06 \text{ V}$$

20.

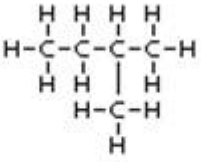
(a) In covalent compounds, electrons are shared between atoms and no charged particles are formed. Hence, they are poor conductors of electricity.

(b) Carbon dioxide is evolved. It turns lime water milky.

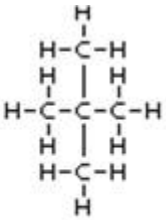
(c) Structural isomers of pentane:



Pentane



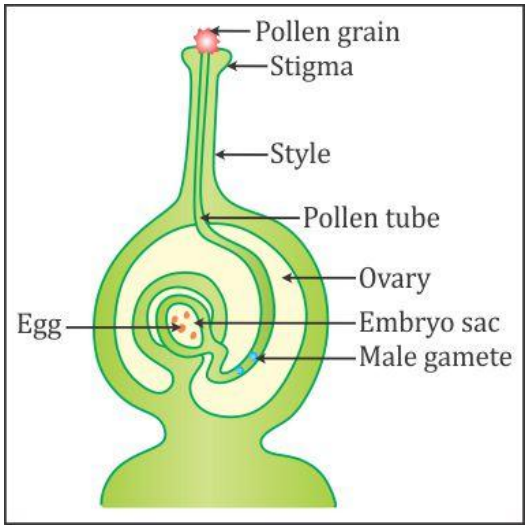
Isopentane



Neopentane

21.

(a)



(b) The ovule becomes a seed, the ovary thickens to form a fruit and the zygote develops into the embryo of the seed.

SECTION B

22. To prepare a good temporary mount of Petunia leaf peel showing many stomata, the student has to get the peel from the lower surface of the leaf.

23. The student wanted to measure equivalent resistance and she connected the voltmeter across T and S only. Hence, the reading was incorrect. She needs to shift the voltmeter and connect it between points T and P.

24. For a concave mirror, the image is formed anywhere between the focus and infinity. So, the screen can be placed between F and infinity. For the second student with the convex mirror, the virtual image always forms at the focus or between the pole and the focus. So, the screen should be placed between P and F.

25. When potassium permanganate is added (in excess) to ethanol, it is oxidised to ethanoic acid.

The chemical reaction involved is

$CH_3CH_2OH \xrightarrow{\text{Alkaline } KMnO_4} CH_3COOH$

26. Fizzing in the reaction is due to the evolution of hydrogen gas by the action of metal on acid.

In test tube A:

$Mg_{(s)} + 2HCl_{(aq)} \rightarrow MgCl_{2\,(aq)} + H_{2\,(g)}$

In test tube B:

$Mg + CH_3COOH_{(aq)} \rightarrow (CH_3COO)_2Mg + H_{2\,(g)}$

Because hydrochloric acid is a strong acid and acetic acid is a weak acid, evolution of H_2 gas occurs more readily in case of HCl.

27. Dry gram seeds neither respire nor produce enough carbon dioxide to turn lime water milky. Therefore, only germinating seeds are used in the carbon dioxide experiment.

OR

<u>Precautions to be taken while conducting the experiment:</u>

- Germinating seeds or living seeds must be used.
- The experimental setup must be airtight.