



CBSE CLASS X SCIENCE (086)
SAMPLE QUESTION PAPER 2026–27

COMPLETE SOLUTION

SECTION – A

BIOLOGY

Q1. During photosynthesis, what happens to carbon dioxide and water as glucose is formed?

Answer: A. Carbon dioxide gains hydrogen, while water loses electrons.

During photosynthesis, carbon dioxide is reduced to glucose by gaining hydrogen, while water undergoes oxidation and loses electrons.

Q2. Lime water turns cloudy in the presence of a gas, which is a by-product of respiration. Shown below are four setups kept in sunlight for 24 hours. In which setup is lime water expected to be the cloudiest?

Answer: C. R

Lime water turns milky due to the presence of carbon dioxide.

In setup **R**, the plant is kept in a closed container with the soil covered. During respiration, the plant releases carbon dioxide. Since the setup is kept in darkness, photosynthesis does not consume the carbon dioxide.

Therefore, maximum carbon dioxide accumulates and the lime water becomes the cloudiest.

Answer: R

Q3. During urine formation, tubular reabsorption and secretion take place in the kidneys. Which of the following sets correctly indicates both the substances that are reabsorbed in the kidneys?

Answer: A. Glucose and salts

During urine formation, useful substances such as **glucose, amino acids, water and salts** are selectively reabsorbed from the filtrate into the blood.

Q4. In a controlled experiment, the anthers of a mustard plant's flowers were carefully removed in the bud stage before they matured. The bud was covered with a paper bag. What will be the most likely result for these flowers?

Answer: C. They will not produce any seeds or fruits.

Removal of anthers prevents the formation and release of pollen grains. Covering the flower prevents pollen from reaching it from another flower.

Therefore, pollination and fertilisation cannot occur, so seeds and fruits will not be formed.

Q5. The Vas deferens and the Oviduct are both targets for surgical contraception (Vasectomy and Tubectomy respectively). Analysing the process of reproduction, what common biological event is prevented by blocking both these structures?

Answer: C. The successful meeting and fusion of the male and female gametes.

- **Vasectomy:** The vas deferens is blocked, preventing sperm from reaching the urethra.
- **Tubectomy:** The oviduct is blocked, preventing the sperm and ovum from meeting.

Thus, **fertilisation is prevented.**

Q6. The male gamete of an apple plant has seventeen chromosomes. What is the number of chromosomes in the female gamete and in the cells of the adult plant respectively?

Answer: B. 17, 34

Gametes are haploid and contain half the chromosome number.

Male gamete = 17 chromosomes

Therefore:

Female gamete = **17 chromosomes**

Adult plant cells = **$17 \times 2 = 34$ chromosomes**

Answer: 17, 34

Q7. A fish living in a pond ecosystem feeds on small aquatic insects (larvae). These insect larvae, in turn, feed on green algae and small photosynthetic bacteria. In this specific food chain, what is the trophic level classification of fish?

Food chain:

Green algae/photosynthetic bacteria → insect larvae → fish

- Producers → first trophic level
- Insect larvae → primary consumers
- Fish → secondary consumers

Answer: C. Secondary Consumer

Q8. The following two questions consist of two statements – Assertion (A) and Reason (R). Answer these questions by selecting the appropriate option given below:

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

Assertion (A): The rate of breathing in aquatic organisms is much lower than in terrestrial organisms.

Reason (R): The amount of oxygen dissolved in water is less than the amount of oxygen in air.

Answer: D. A is false but R is true.

Aquatic organisms generally breathe **more rapidly** because the amount of dissolved oxygen in water is much lower than the amount of oxygen available in air.

Therefore:

- Assertion = False
 - Reason = True
-

Q9. Assertion–Reason

Assertion (A): In an ecosystem, 1% of energy is available for transfer from one trophic level to the next.

Reason (R): An average of 10% of the food eaten by organisms is available for flow in the form of chemical energy.

Answer: D. A is false but R is true.

According to the **10% law**, only about **10% of the energy** at one trophic level is transferred to the next trophic level.

Therefore, the assertion stating 1% is incorrect.

Q10.

A. Due to narrowing of the bile duct, the bile secretion from the liver to the small intestine was obstructed. How will the process of digestion be affected?

Bile is produced by the liver and stored in the gall bladder. It is released into the small intestine.

Bile helps in:

1. **Emulsification of fats**, breaking large fat globules into smaller droplets.
2. Providing an **alkaline medium** for the action of enzymes.

If the bile duct is narrowed, less bile reaches the small intestine. Therefore, the **digestion of fats will be affected**, especially their emulsification.

B. How does the length of the intestine depend on the nature of food habit in different animals?

The length of the intestine depends on the type of food eaten.

- **Herbivores:** Have a longer small intestine because plant material, particularly cellulose, requires more time for digestion.
 - **Carnivores:** Have a comparatively shorter intestine because meat is easier to digest.
 - **Omnivores:** Have an intermediate length of intestine.
-

Q11.

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

The **medulla oblongata**, a part of the hindbrain, controls many involuntary activities.

Such activities are called **involuntary actions**.

Examples:

1. Breathing
2. Heartbeat

Other examples include blood pressure and vomiting.

OR

B. How is the information of touch in the 'sensitive plant' controlled and coordinated?

When the leaves of a sensitive plant such as *Mimosa pudica* are touched, the stimulus is transmitted from cell to cell through electrical and chemical signals.

The cells at the base of the leaf or leaflet undergo changes in their water content and **turgor pressure**. This causes the leaves to fold or droop.

Thus, the response is coordinated through **changes in water movement and turgidity of cells**, without the involvement of a nervous system.

Q12. What changes are observed in the uterus subsequent to implantation of the young embryo in a human female?

After implantation of the embryo:

1. The lining of the uterus becomes **thick and richly supplied with blood vessels**.
 2. It provides nourishment and support to the developing embryo.
 3. The placenta develops, which facilitates the exchange of **nutrients, oxygen and waste materials** between the mother and embryo.
 4. The embryo remains attached to the uterine wall for further development.
-

Q13. How do muscles move at the cellular level and respond when processed messages are received from the brain?

Muscle movement occurs through the interaction of **actin and myosin filaments**.

When a message from the brain reaches the muscle through a motor neuron:

1. The muscle receives the nerve impulse.
2. Calcium ions are released inside the muscle fibre.
3. Calcium allows the interaction between **actin and myosin**.

4. Myosin uses energy from **ATP** to pull the actin filaments.
5. The muscle fibres shorten, producing **muscle contraction and movement**.

When the stimulation stops, the muscle relaxes.

Q14. Study the food chain given below:

Phytoplankton → Zooplankton → Small fish → Large fish

A. In the given food chain, the amount of energy available at the fourth trophic level is 10 kJ, what will be the energy available at the producer level?

Fourth trophic level = Large fish = **10 kJ**

According to the 10% law:

Producer → 10% → Zooplankton → 10% → Small fish → 10% → Large fish

Therefore:

10% of 10% of 10% of producer energy = 10 kJ

Let producer energy = E.

$$E \times \frac{10}{100} \times \frac{10}{100} \times \frac{10}{100} = 10$$
$$E \times \frac{1}{1000} = 10$$
$$E = 10,000 \text{ kJ}$$

Answer: 10,000 kJ

B. Is it possible to have three more trophic levels in the above food chain? Justify

No.

At every successive trophic level, only about **10% of the energy** is transferred to the next level. Most of the energy is lost in life processes.

Therefore, very little energy would remain to support additional trophic levels.

C. Which of these trophic levels will have the maximum amount of pesticide, if it had washed down in the water body from agricultural fields. Why?

Large fish, i.e. the **fourth trophic level**, will have the maximum concentration.

This is because of **biomagnification**. Non-biodegradable pesticides accumulate progressively at higher trophic levels.

Q15. In order to study patterns of inheritance, Neha had performed typical Mendelian experiments with pea plants in the field. In experiment one, she crossed a pea plant having white flowers (vv) with another pea plant bearing violet flowers (VV). In another experiment, in addition to the colour of the flower she also focussed on the height of the pea plant. This time she crossed a pea plant having violet flowers and tall height (VVTT) with another pea plant having white flowers and short height (vvtt). What percentage is expected for the following traits as a result of these experiments? Give a reason.

Experiment 1

White flowers = **vv**

Violet flowers = **VV**

Cross:

VV × vv

Gametes:

V and v

F₁:

All Vv

Since violet is dominant, all F₁ plants have violet flowers.

F₁ self-cross:

Vv × Vv

Genotypic ratio:

1 VV : 2 Vv : 1 vv

Phenotypic ratio:

3 Violet : 1 White

A. Violet flowers in F₁ and F₂

F₁ = 100% violet

F₂ = 75% violet

Reason: Violet colour is dominant over white.

Experiment 2

VVTT × vvtt

Gametes:

VVTT → VT

vvtt → vt

Therefore:

F₁ = VvTt

All F₁ plants are:

Violet and Tall

When F₁ plants are crossed:

VvTt × VvTt

Phenotypic ratio:

9 Violet Tall : 3 Violet Short : 3 White Tall : 1 White Short

B. Tall height plants with white flowers in F₂ generation in experiment two?

White = vv

Tall = T₋

Therefore:

vvT₋

Probability:

$$\frac{1}{4} \times \frac{3}{4} = \frac{3}{16} \\ = \boxed{18.75\%}$$

C. Percentage of medium height plants with light violet flowers in F₁ and F₂ generations in experiment two? Give a reason.

Under the Mendelian inheritance described in the question, **complete dominance** is being considered.

Therefore, intermediate phenotypes such as **medium height and light violet flowers are not produced.**

$F_1 = 0\%$

$F_2 = 0\%$

OR

D. Percentage of short height plants with white flowers in F1 and F2 generations in experiment two?

Short = tt

White = vv

Therefore:

vvtt

In F_1 :

0%

In F_2 :

$$\frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$$
$$= \boxed{6.25\%}$$

Q16. Attempt either option A or B



Option A – Observe the structure of hearts A, B and C shown above and answer the following questions

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

Heart C represents the four-chambered heart found in birds and mammals.

It contains:

- Two atria

- Two ventricles

There is complete separation between oxygenated and deoxygenated blood.

Therefore, oxygen-rich and oxygen-poor blood do not mix. This allows efficient oxygen supply and a high metabolic rate, enabling birds and mammals to maintain a **constant body temperature**.

II. Which of the hearts depicted above is present in fishes, how does circulation of blood take place in them?

Heart A represents the two-chambered heart of fishes.

It has:

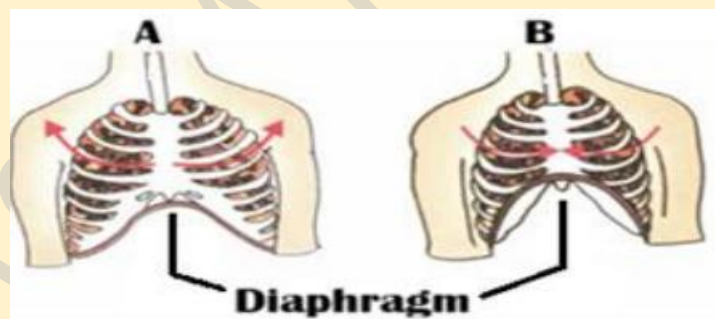
- One atrium
- One ventricle

Fish show **single circulation**.

Blood passes through the heart once during one complete cycle:

Heart → gills → body tissues → heart

Option B –



I. Observe both the diagrams A and B. Which diagram indicates inhalation? Describe how it occurs.

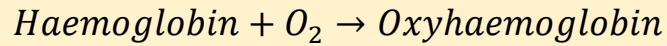
Diagram A represents inhalation.

During inhalation:

1. The diaphragm contracts and becomes **flattened**.
2. The ribs move **upward and outward**.
3. The volume of the thoracic cavity increases.
4. Pressure inside the lungs decreases.
5. Air enters the lungs.

II. If diffusion were to move oxygen in our body, it is estimated that it would take 3 years for a molecule of oxygen to get to our toes from our lungs. Then, how is oxygen delivered to all parts of our body? Oxygen is transported mainly by haemoglobin present in red blood cells.

In the lungs:



The oxygen-rich blood is pumped by the heart to different parts of the body.

At tissues, oxygen is released and used by cells during respiration.

For visually impaired students

A.

I. How many chambers are present in the hearts of birds and mammals and how are they able to maintain their body temperature? Give reason for your answer

Birds and mammals have four-chambered hearts, consisting of two atria and two ventricles.

They are able to maintain a constant body temperature because their four-chambered hearts completely separate oxygenated blood from deoxygenated blood. As a result, highly oxygenated blood is efficiently supplied to the body tissues, ensuring a continuous and sufficient supply of oxygen for cellular respiration and energy production.

Thus, the efficient supply of oxygen supports their high metabolic rate, helping them maintain a nearly constant body temperature irrespective of the temperature of their surroundings.

Answer: Birds and mammals have four chambers in their hearts. Complete separation of oxygenated and deoxygenated blood ensures efficient oxygen supply and a high metabolic rate, enabling them to maintain a constant body temperature.

II. How many chambers are present in the heart of fishes, how does circulation of blood take place in them?

The heart of a fish has two chambers:

- **One atrium**

- **One ventricle**

Fishes show **single circulation**. The deoxygenated blood from the body enters the heart and is pumped to the **gills**, where it gets oxygenated. The oxygenated blood then flows directly from the gills to the **rest of the body**. After delivering oxygen, the blood becomes deoxygenated and returns to the heart.

Thus, the blood passes through the **heart only once during one complete cycle of circulation**.

B.

I. Describe the process of inhalation and also mention how are the lungs designed in human beings to maximise the area for exchange of gases?

Inhalation is the process by which air rich in oxygen is taken into the lungs.

During inhalation:

1. The **diaphragm contracts** and moves downward, becoming flattened.
2. The **muscles between the ribs contract**, causing the ribs to move **upwards and outwards**.
3. As a result, the volume of the chest cavity increases.
4. The pressure inside the lungs decreases below the atmospheric pressure.
5. Air from outside rushes into the lungs.

Adaptation of lungs for maximum gaseous exchange

The lungs contain millions of tiny balloon-like structures called **alveoli**. These provide a **very large surface area** for the exchange of gases. The walls of the alveoli are **very thin** and are surrounded by a dense network of **blood capillaries**.

Thus, oxygen can easily diffuse from the alveoli into the blood, while carbon dioxide diffuses from the blood into the alveoli.

Therefore, the large number of alveoli, their thin walls and rich blood supply make the lungs highly efficient for the exchange of gases.

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

If oxygen had to reach every part of the body only by **diffusion**, it would take a very long time. Therefore, in human beings, oxygen is transported rapidly by the **circulatory system**.

When we inhale, oxygen reaches the **alveoli** of the lungs. It diffuses through the thin walls of the alveoli into the surrounding blood capillaries. The oxygen then combines with **haemoglobin present in red blood cells** to form oxyhaemoglobin.

The **heart pumps oxygenated blood** through arteries to different parts of the body. At the tissues, oxygen is released from haemoglobin and diffuses into the cells, where it is used for **cellular respiration and energy production**.

Thus, oxygen is delivered to all parts of the body through the **combined action of the lungs, blood and heart**, rather than by diffusion over the entire distance from the lungs to the toes.

SECTION – B

CHEMISTRY

Q17. Chameleons contain crystals that reflect light and produce colour. Adjusting the spacing between these crystals, they can alter the wavelengths of light reflected, thus changing their skin colour. Based on the above information, we can infer that the change in colour by chameleons is a: Answer: C. Physical change because the space between crystals is adjusted.

The change occurs due to alteration in the spacing of crystals and the wavelength of reflected light. No new substance is formed.

Therefore, it is a **physical change**.

Q18. Rishita summarizes the chlor-alkali process in the following table

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

The chlor-alkali process produces:

- Hydrogen at the cathode
- Chlorine at the anode
- Sodium hydroxide near the cathode

Hydrogen can be used as a fuel and sodium hydroxide is used in making soap.

Therefore:

Answer: B. I and III

Q19. Manjeet wants to wash clothes, but the water available is hard. He compares the action of soap and detergent in hard water, to decide which one to use for washing his clothes. He observes:

- Soap forms scum in hard water.
- Detergent produces lather easily in hard water. Which of the following inferences is correct?

Answer: A.

Ca^{2+} and Mg^{2+} ions present in hard water react with soap to form insoluble salts called **scum**.

Detergents generally do not form such insoluble precipitates with Ca^{2+} and Mg^{2+} ions.

Q20. Which of the following salts contain water of crystallisation:

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

- Plaster of Paris $\rightarrow \text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$
- Washing soda $\rightarrow \text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
- Baking soda $\rightarrow \text{NaHCO}_3$
- Gypsum $\rightarrow \text{CaSO}_4 \cdot 2\text{H}_2\text{O}$

Therefore, the correct combination is:

(i), (ii) and (iv)

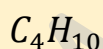
Answer: D

Q21. Which of the following pair of compounds are isomers?

Answer: A

The first compound is **n-butane** and the second is **isobutane**.

Both have the same molecular formula:



but different structures.

Therefore, they are **isomers**.

For visually impaired students

The unsaturated hydrocarbon with three carbon atoms is:

A. propene B. propane C. pentane D. pentene

Answer: A. Propene

Explanation:

An **unsaturated hydrocarbon** contains at least one **carbon-carbon double or triple bond**.

- **Propene:** $\text{C}_3\text{H}_6 \rightarrow$ contains a $\text{C}=\text{C}$ double bond $\rightarrow$ **unsaturated**
- **Propane:** $\text{C}_3\text{H}_8 \rightarrow$ only single bonds $\rightarrow$ **saturated**
- **Pentane:** $\text{C}_5\text{H}_{12} \rightarrow$ **saturated**
- **Pentene:** $\text{C}_5\text{H}_{10} \rightarrow$ **unsaturated**, but has **five** carbon atoms

Therefore, the unsaturated hydrocarbon having **three carbon atoms** is:

Q22. A food label is given below. E304 and E307b are added to the flavoured biscuits.



E304 and E307b are antioxidants used to prevent oxidation of food.

Nitrogen is used in food packaging because it prevents oxidation by replacing oxygen.

Answer: C. Nitrogen

For visually impaired students:

In the food industry nitrogen is used as a/an

A. preservative. B. oxidising agent. C. antioxidant. D. colouring agent.

Answer: A. Preservative

Q23. Electrical wires made of aluminum

A. corrode easily as aluminium is a very reactive metal.

B. corrode easily because porous flaky aluminium oxide is formed.

C. do not corrode easily as aluminium oxide forms a protective layer.

D. do not corrode easily as aluminium is less reactive than metals like sodium, magnesium and zinc.

Answer: C.

Aluminium reacts with oxygen to form a thin, tough and protective layer of **aluminium oxide (Al_2O_3)**.

This layer prevents further corrosion.

Q24. The following question consists of two statements – Assertion (A) and Reason (R).

Answer this question by selecting the appropriate option given below:

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

Assertion: Onion extract loses its smell when added to baking soda solution but retains its smell in lemon juice.

Reason: Onion acts as an olfactory indicator.

Answer: B. Both A and R are true, and R is not the correct explanation of A.

Q25. Carbon forms millions of compounds whereas silicon, which is just below it in the Periodic Table, forms a few compounds. Explain the reason for the difference in their ability to form compounds.

Carbon forms a very large number of compounds mainly because of:

1. **Catenation** – carbon atoms can form strong C–C bonds and make long chains, branched chains and rings.
2. **Tetravalency** – carbon has valency four and can form bonds with carbon and many other elements.
3. Carbon can form stable **single, double and triple bonds**.

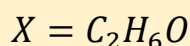
Silicon is larger in size, so the Si–Si bond is weaker than the C–C bond. Hence, silicon has much less tendency for extensive catenation.

Q26. Attempt either option A or B. A. An organic compound "X" with formula C_2H_6O is used to blend with petrol in order to reduce the dependence on fossil fuels and lower down the harmful emissions from the cars. It is also used as a solvent in medicines such as tincture iodine, cough syrups and many tonics.

- (i) Draw the electron dot structure of "X".
- (ii) Write the name and formula of the next homologue of "X".
- (iii) Write the reaction of "X" with acetic acid to form a sweet smelling substance.

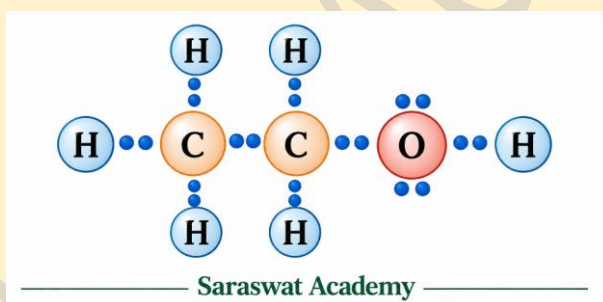
Option A

Given:



The compound is **ethanol** (C_2H_5OH).

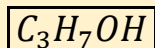
(i) Electron-dot structure



(ii) Next homologue

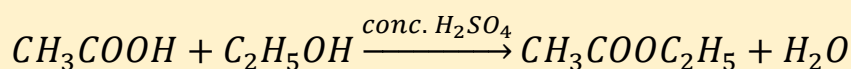
The next homologue is **propanol**.

Formula:



(iii) Reaction with acetic acid

Ethanol reacts with acetic acid in the presence of concentrated H_2SO_4 to form the sweet-smelling ester **ethyl ethanoate**.



This reaction is called **esterification**.

Option B

Ramya performs an experiment in the following two steps: Step 1: Heats ethanol with conc. H_2SO_4 at $170^\circ C$ to get product A. Step 2: Passes hydrogen gas over product A, using Ni as a catalyst and gets product B.

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

(i) Products A and B

When ethanol is heated with concentrated H_2SO_4 at $170^\circ C$:

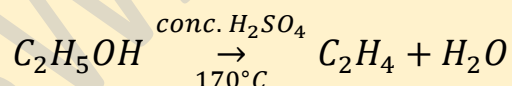
A = Ethene

When ethene is passed over hydrogen in the presence of Ni:

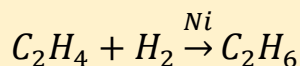
B = Ethane

(ii) Reactions

Step 1: Dehydration



Step 2: Hydrogenation



For visually impaired students

Attempt either option A or B.

A. An organic compound "X" with formula C_2H_6O is used to blend with petrol in order to reduce the dependence on fossil fuels and lower down the harmful

emissions from the cars. It is also used as a solvent in medicines such as tincture iodine, cough syrups and many tonics.

(i) Name the compound X.

Ethanol

Molecular formula:

C_2H_5OH

(ii) Formula of the next homologue of X

The next homologue of ethanol is **propanol**.

C_3H_7OH

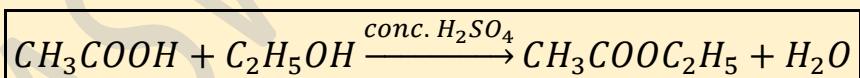
or

C_3H_8O

It differs from ethanol by one **–CH₂–** group.

(iii) Reaction of X with acetic acid

Ethanol reacts with acetic acid in the presence of concentrated sulphuric acid to form the sweet-smelling ester **ethyl ethanoate (ethyl acetate)**.



This reaction is called **esterification**.

OR

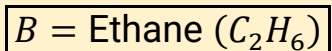
Option B

(i) Name the products A and B.

In Step 1, ethanol is heated with concentrated H₂SO₄ at 170°C. It undergoes **dehydration** to form:

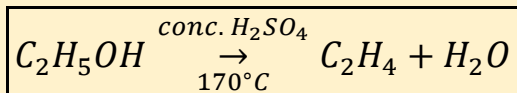
A = Ethene (C₂H₄)

In Step 2, ethene reacts with hydrogen in the presence of Ni catalyst. It undergoes **hydrogenation** to form:



(ii) Reactions involved

Step 1: Dehydration of ethanol



Step 2: Hydrogenation of ethene

Q27. Give reasons.

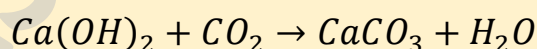
A. A solution of sports electrolyte drink conducts electricity, but coconut oil does not.

An electrolyte drink contains dissolved ions such as Na^+ , K^+ and Cl^- . These ions are free to move and carry electric current.

Coconut oil consists mainly of covalent molecules and does not provide free ions. Therefore, the electrolyte drink conducts electricity whereas coconut oil does not.

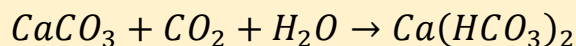
B. Milkiness disappears when excess of carbon dioxide is passed through lime water.

Initially:



The insoluble calcium carbonate makes lime water milky.

When excess CO_2 is passed:



Calcium hydrogen carbonate is soluble in water.

Therefore, the milkiness disappears.

C. An iron bridge near the sea rusts much faster than an iron bridge located in a dry hilly region.

Air near the sea contains more **moisture and dissolved salts**.

Water and oxygen are necessary for rusting, while salts increase the conductivity of water and accelerate corrosion.

Therefore, an iron bridge near the sea rusts faster than one in a dry hilly region.

Q28. Aavya and Vihan are studying the properties of metals in school. They decide to design and conduct an experiment to test the relative conduction of heat by metals. They use the apparatus (Figure) with rods of five different metals aluminium, silver, copper, iron and zinc attached to a central point. This central point is heated using a burner. The metal rods are of equal length and thickness. They observe that the candles at the end of the rods fall at different times. (Study the graph)

A. On the basis of the graph obtained, which metal is the best conductor of heat?

From the graph, **silver** takes the least time for the candle to fall.

Therefore:

Answer: Silver

B. Gold is a better conductor of heat than aluminium but it is not as good as copper. The time taken for the candle to drop if one of the rods were made of gold would have been: (i) 15 s (ii) 20 s (iii) 35 s (iv) 10 s

Time taken by gold

From the graph:

- Copper = 20 s
- Aluminium = 30 s

Gold is stated to be a better conductor than aluminium but not as good as copper.

Therefore, its time should logically lie **between 20 s and 30 s**.

Correct answer = 20s

Attempt either sub-part C or D

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

Yes, the time required would increase.

A longer rod provides a greater distance for heat to travel from the heated end to the candle. Therefore, heat would take more time to reach the end.

OR

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

No, the inference would not be reliable.

The rods must have the same length and thickness for a fair comparison.

Different thicknesses affect the rate of heat conduction because the cross-sectional area affects heat flow.

Therefore, unequal thickness would make the experiment **uncontrolled and unreliable**.

For visually impaired students

Aavya and Vihan are studying the properties of metals in school. They decide to design and conduct an experiment to test the relative conduction of heat by metals. They use rods of equal length and thickness made of five different metals – A, B, C, D and E. A heat sensor is attached at one end of each rod. The other end of the rod is heated and time required for the heat sensor to beep is noted for all metal rods. The heat sensor at the end of B rod beeps in 10 seconds, C rod in 15 seconds, A a 30 seconds, E in 50 seconds and D sensor beeps in 60 seconds.

A. On the basis of the experimental result, which metal is the best conductor of heat?

Metal **B** takes the least time, only **10 seconds**, for the heat to reach the sensor.

B. Metal G is a better conductor of heat than metal A but it is not as good as metal C. The time taken for the sensor to beep if one of the rods were made of G would have been: (i) 15 s (ii) 20 s (iii) 35 s (iv) 10 s

Time taken by metal G

Given:

- G is a better conductor than A.
- G is not as good a conductor as C.

The times are:

$$C = 15s$$

$$A = 30s$$

Therefore, the time taken by G should lie between 15 s and 30 s.

Ans = 20s

Attempt either sub-part C or D.

C. The length of all the metal rods is increased by 20% without any change in the thickness. Will the time required for the sensor to beep be affected? How and why?

Yes, the time required for the heat sensor to beep will increase.

A longer rod provides a greater distance for heat to travel from the heated end to the sensor. Therefore, heat will take more time to reach the other end.

Thus, the sensor will beep after a longer time.

Answer: The time will increase because the distance through which heat has to travel has increased by 20%.

D. Mayank tries the experiment with little variation. He keeps the length of all the rods of the same length, but, the thickness of rods is not the same. Will the inference he draws on the basis of his experiment be correct? Justify your answer.

No, the inference would not be correct.

For a fair comparison of the thermal conductivity of different metals, the rods should have the same length and same thickness.

If the thicknesses are different, the rate at which heat is conducted will also be affected by the cross-sectional area of the rods. A thicker rod can conduct heat differently from a thinner rod.

Therefore, any difference in the time taken by the sensors could be due to both the nature of the metal and the different thicknesses, making the experiment unreliable.

Q29. Attempt either option A or B. A.

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

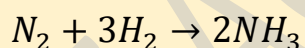
Alisha: The formation of ammonia by reaction of nitrogen with hydrogen is a reduction reaction.

Drishti: Both rusting of iron and formation of ammonia are redox reactions.

Bhushan: Rusting of iron is an oxidation reaction.

Alisha:

Nitrogen reacts with hydrogen:



Nitrogen changes from oxidation state 0 to -3 , so nitrogen is **reduced**.

Hydrogen changes from 0 to $+1$, so hydrogen is **oxidised**.

Thus, formation of ammonia is a **redox reaction**, not merely a reduction reaction.

Therefore, Alisha's statement is incomplete/incorrect.

Drishti:

Both rusting of iron and formation of ammonia involve oxidation and reduction processes.

Therefore, both are **redox reactions**.

Drishti is correct.

Bhushan:

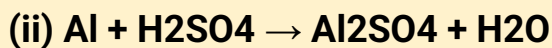
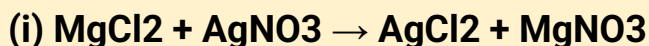
In rusting, iron is oxidised to iron ions/iron compounds.

Therefore, rusting involves oxidation.

Bhushan's statement is correct at the level of oxidation of iron.

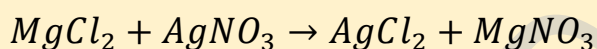
Therefore, Drishti and Bhushan are correct.

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

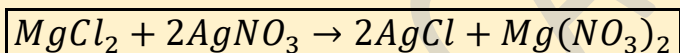


(i)

Incorrect:

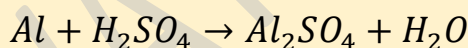


Correct equation:

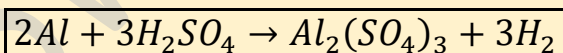


(ii)

Incorrect:



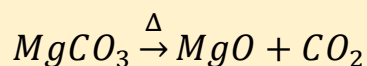
Correct equation:



Option B

I. Refer to the dialogue between Daljeet and Avik in the chemistry lab. They have learnt about decomposition reactions. Who has understood decomposition reactions correctly? Justify your answer. Daljeet: During a decomposition reaction, a substance decomposes to give two simpler compounds. MgCO_3 decomposes on heating to magnesium oxide and carbon dioxide. Avik: No, during a decomposition reaction, a substance decomposes to give two elements. Water on electrolysis gives hydrogen and oxygen, both are elements.

Daljeet gives a correct example:



A decomposition reaction is a reaction in which **one compound breaks down into two or more simpler substances**.

Avik's statement that a decomposition reaction always produces two elements is incorrect because the products may be elements or compounds.

Therefore, **Daljeet has understood the concept correctly**, although the most complete definition is that a compound decomposes into two or more simpler substances.

II. Analyse the observations given in following two cases. Are these observations correct? Give reasons to support your answer.

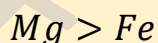
- (i) **Iron filings are added to an aqueous solution of magnesium sulphate. Observation: The colourless solution turns greenish due to formation of iron sulphate.**

Iron filings + magnesium sulphate

Observation given: The solution becomes green due to formation of iron sulphate.

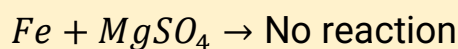
Incorrect.

Iron is less reactive than magnesium:



Therefore, iron cannot displace magnesium from magnesium sulphate.

No reaction occurs:



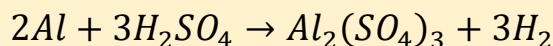
Hence, the solution remains colourless.

(ii) Aluminium metal is added to dilute sulphuric acid Observation: Brisk effervescence are seen due to evolution of a gas.

Observation: Brisk effervescence due to evolution of a gas.

Correct.

Aluminium reacts with dilute sulphuric acid to produce hydrogen gas:



The evolved hydrogen produces effervescence.

SECTION – C

PHYSICS

Q30. A student wants to determine the focal length of a convex lens using sunlight. Which of the following practical procedures will give the most accurate result?

Answer: B.

The lens should be held above a sheet of paper and adjusted until the **smallest and brightest spot** is obtained.

Sunlight consists of nearly parallel rays. When these rays converge to the smallest bright spot, the distance between the lens and the paper gives approximately the **focal length** of the convex lens.

Q31 An electrical appliance rated 1000 W is operated at 250 V. What current does it draw?

Given:

$$P = 1000W$$
$$V = 250V$$

Using:

$$P = VI$$
$$I = \frac{P}{V}$$
$$I = \frac{1000}{250}$$
$$\boxed{I = 4A}$$

Answer: C. 4.0 A

**Q32. The following one question consists 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.

Assertion: Apparent depth of a coin in water is less than its real depth.

Reason: Light bends away from the normal when it travels from water to air.

Answer: A. Both A and R are true, and R is the correct explanation of A.

Light travels from the denser medium, water, to the rarer medium, air, and bends away from the normal.

Due to this refraction, the coin appears to be raised and hence its apparent depth is less than its real depth.

Q33.

A. State Snell's Law of refraction.

For a given pair of transparent media:

$$\frac{\sin i}{\sin r} = \text{constant}$$

where:

- i = angle of incidence
- r = angle of refraction

More generally:

$$n_1 \sin i = n_2 \sin r$$

B. Define the refractive index of a material with respect to another material giving the mathematical expression.

The refractive index of medium 2 with respect to medium 1 is:

$$n_{21} = \frac{\sin i}{\sin r}$$

It can also be expressed as:

$$n_{21} = \frac{v_1}{v_2}$$

where v_1 and v_2 are the speeds of light in the two media.

Q34. Attempt either option A or B.

Option A

I. State Joule's Law of heating.

The heat produced in a conductor carrying current is:

$$H = I^2 R t$$

Thus, heat produced is directly proportional to:

- square of current,
- resistance,
- time.

II. What happens to the heat produced in a conductor if the resistance is doubled while keeping other variables constant?

Given:

$$H = I^2 R t$$

If resistance becomes $2R$:

$$H' = I^2 (2R) t$$

$$H' = 2H$$

Therefore, the heat produced becomes **twice** the original value.

Option B

I. Define resistivity.

Resistivity is the resistance of a conductor having **unit length and unit cross-sectional area**.

It is represented by ρ .

$$\rho = \frac{RA}{l}$$

SI unit:

$$\Omega m$$

II. Justify with an example why resistivity is an intrinsic property of a material.

Resistance depends on length and area:

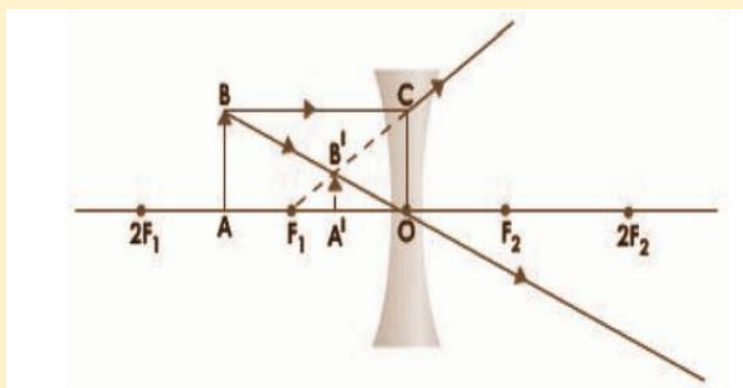
$$R = \rho \frac{l}{A}$$

But resistivity depends only on the **nature of the material and temperature**.

For example, a thin copper wire and a thick copper wire have different resistances because their lengths and areas may differ, but at the same temperature, copper has the same resistivity.

Q35. A concave lens forms an image that is 1/3rd the size of the object, as shown in the diagram. If the object is placed 24 cm in front of the lens, determine:

- A. the type of lens.**
- B. the image distance**
- C. the focal length of the lens**



Given:

Object distance:

$$u = -24\text{cm}$$

Image is one-third the size of the object:

$$m = \frac{1}{3}$$

For a lens:

$$m = \frac{v}{u}$$

Therefore:

$$\begin{aligned}\frac{1}{3} &= \frac{v}{-24} \\ v &= -8\text{cm}\end{aligned}$$

A. Type of lens

The lens is a **concave lens**.

B. Image distance

$$\boxed{v = -8\text{cm}}$$

The negative sign indicates that the image is formed on the same side of the lens as the object.

C. Focal length

Using the lens formula:

$$\begin{aligned}\frac{1}{f} &= \frac{1}{v} - \frac{1}{u} \\ \frac{1}{f} &= \frac{1}{-8} - \frac{1}{-24} \\ \frac{1}{f} &= -\frac{1}{8} + \frac{1}{24} \\ \frac{1}{f} &= -\frac{3}{24} + \frac{1}{24} \\ \frac{1}{f} &= -\frac{2}{24}\end{aligned}$$

$$\frac{1}{f} = -\frac{1}{12}$$

Therefore:

$$\boxed{f = -12\text{cm}}$$

For visually impaired students:

A student places an object 24 cm from a convex lens of focal length 12 cm. Calculate the image position and determine whether the image is real or virtual.

Given:

$$u = -24\text{cm}, f = +12\text{cm}$$

Using:

$$\begin{aligned}\frac{1}{f} &= \frac{1}{v} - \frac{1}{u} \\ \frac{1}{12} &= \frac{1}{v} + \frac{1}{24} \\ \frac{1}{v} &= \frac{1}{12} - \frac{1}{24} \\ \frac{1}{v} &= \frac{1}{24}\end{aligned}$$

Therefore:

$$\boxed{v = +24\text{cm}}$$

The image is **real and inverted**, formed on the other side of the convex lens.

Q36.

A. State the Right-Hand Thumb Rule and describe how it helps determine the direction of magnetic field around a current-carrying conductor

If a straight current-carrying conductor is held in the **right hand** with the thumb pointing in the direction of current, then the curled fingers give the direction of the magnetic field around the conductor.

Thus:

- Thumb → direction of current
- Curled fingers → direction of magnetic field

B. Explain how the magnetic field changes with distance from the conductor.

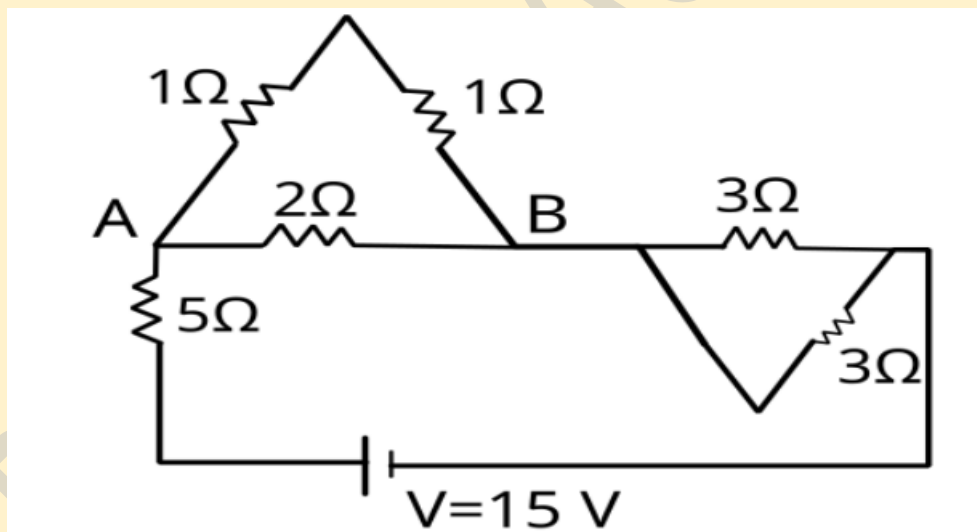
The magnetic field around a straight current-carrying conductor decreases as the distance from the conductor increases.

For a long straight conductor:

$$B \propto \frac{1}{r}$$

Thus, the magnetic field is **stronger near the conductor** and weaker farther away.

Q37.



The figure shows a circuit with a 15 V battery connected to several resistors. Using the given circuit diagram: A. Find the total current supplied by the battery. B. Calculate the potential difference between points A and B.

The circuit contains:

- Two 1 Ω resistors in series in the upper branch
- A 2 Ω resistor between A and B
- A 5 Ω resistor in series with the network
- Two 3 Ω resistors in parallel on the right side.

A. Find the total current supplied by the battery.

Between A and B:

The upper branch has:

$$1 + 1 = 2\Omega$$

This 2Ω branch is parallel to the 2Ω resistor between A and B.

Therefore:

$$R_{AB} = \frac{2 \times 2}{2 + 2}$$
$$R_{AB} = 1\Omega$$

On the right:

Two 3Ω resistors are in parallel:

$$R = \frac{3 \times 3}{3 + 3}$$
$$R = 1.5\Omega$$

Important: From the actual diagram, the lower diagonal wire connects the left junction of the right-hand 3Ω network directly to the lower vertex, so the two 3Ω resistors are effectively connected in parallel between the same two nodes.

Thus:

$$R_{\text{total}} = 5 + 1 + 1.5$$
$$R_{\text{total}} = 7.5\Omega$$

Therefore:

$$I = \frac{V}{R}$$
$$I = \frac{15}{7.5}$$
$$\boxed{I = 2A}$$

B. Calculate the potential difference between points A and B.

Current through the A-B equivalent resistance is 2 A.

$$V_{AB} = IR_{AB}$$

$$V_{AB} = 2 \times 1$$

$$\boxed{V_{AB} = 2V}$$

For visually impaired students

A 15 V battery is connected in series with three resistors of 2 Ω , 3 Ω , and 5 Ω . Calculate:

- A. The total resistance in the circuit.**
- B. The total current supplied by the battery.**
- C. The voltage drop across the 3 Ω resistor.**

Given:

$$R_1 = 2\Omega, R_2 = 3\Omega, R_3 = 5\Omega$$

All are in series.

A. Total resistance

$$R = 2 + 3 + 5$$

$$\boxed{R = 10\Omega}$$

B. Total current

$$I = \frac{V}{R}$$

$$I = \frac{15}{10}$$

$$\boxed{I = 1.5A}$$

C. Voltage drop across 3 Ω resistor

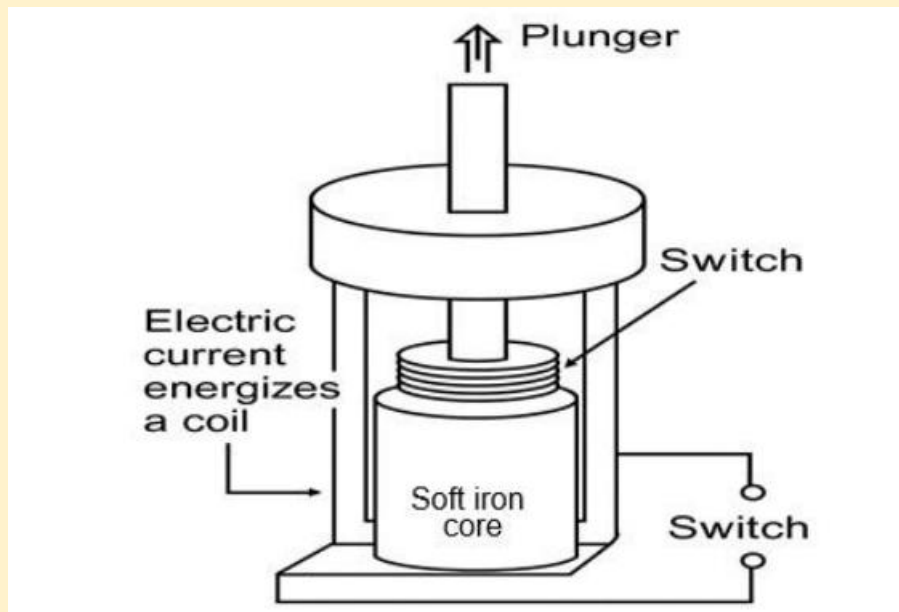
$$V = IR$$

$$V = 1.5 \times 3$$

$$\boxed{V = 4.5V}$$

Q38. A school has installed an automatic electromagnetic door-locking system at the main entrance. The locking mechanism uses a solenoid controlled by a switch at the security desk. When electricity flows through the solenoid, it creates a

magnetic field strong enough to pull an iron bolt, unlocking the door. As soon as the switch is turned off, the magnetic field disappears, and a spring pushes the bolt back, locking the door.



A. Why is an iron core kept inside the solenoid in this locking mechanism?

A **soft iron core** is placed inside the solenoid because it becomes strongly magnetised when current flows through the coil.

It greatly **increases the strength of the magnetic field** produced by the solenoid.

Soft iron is used because it loses its magnetism quickly when the current is switched off.

Thus, it is suitable for an electromagnetic door lock.

B. How can we determine the magnetic poles in this solenoid?

The magnetic poles of a solenoid can be determined using the **Right-Hand Thumb/Grip Rule**.

When the fingers of the right hand are curled in the direction of current through the coil, the extended thumb indicates the **north pole** of the solenoid.

Alternatively, a magnetic compass can be used to identify the poles.

C. If the current in the solenoid is increased from 1 A to 2 A, explain how the magnetic effect changes and its effect on unlocking the door.

The magnetic field of a solenoid increases when the current through it increases.

Therefore, increasing current from 1 A to 2 A makes the solenoid **stronger**.

The stronger magnetic field exerts a greater force on the iron bolt/plunger, making the unlocking action more effective.

OR

D. If the source of the current is fixed, how can we increase the magnetic field in the solenoid?

The magnetic field of a solenoid can be increased by:

1. Increasing the **number of turns of the coil**.
2. Increasing the number of turns per unit length.
3. Using a **soft iron core** inside the solenoid.

For visually impaired students

A student places a small magnetic compass on a wooden table and aligns it so that the compass needle points naturally toward North–South. She then stretches a straight charging cable above the compass so that the wire is parallel to the compass needle. When the phone charger is switched on and current begins to flow through the wire, the compass needle deflects away from its North–South position.

A. What causes the compass needle to deflect when current flows through the wire?

When current flows through the wire, it produces a **magnetic field around the wire**. This magnetic field interacts with the magnetic field of the compass needle and causes the needle to **deflect from its North–South direction**.

Answer: The compass needle deflects due to the **magnetic field produced by the current-carrying wire**.

B. What happens to the compass needle when the current in the wire is switched off?

When the current is switched off, the magnetic field produced by the wire disappears.

Therefore, the compass needle is no longer affected by the magnetic field of the wire and returns to its **original North–South direction** under the influence of Earth's magnetic field.

Answer: The compass needle returns to its **North–South position**.

C. Explain how the amount of current in the wire affects the magnitude of deflection of the compass needle?

The strength of the magnetic field around a current-carrying conductor **increases with an increase in current**.

Therefore:

- **More current** → **stronger magnetic field** → **greater deflection of the compass needle**.
- **Less current** → **weaker magnetic field** → **smaller deflection**.

Thus, the magnitude of deflection of the compass needle increases as the current through the wire increases.

OR

D. When the direction of current is reversed, the compass deflects in the opposite direction. Explain how the Right-Hand Thumb Rule accounts for this change.

According to the **Right-Hand Thumb Rule**, if a straight current-carrying conductor is held in the right hand with the thumb pointing in the direction of current, the curled fingers indicate the direction of the magnetic field around the conductor.

When the **direction of current is reversed**, the direction of the magnetic field around the wire also reverses.

Therefore, the magnetic field acts on the compass needle in the opposite direction, causing the needle to **deflect in the opposite direction**.

Answer: Reversing the current reverses the magnetic field, so the compass needle also deflects in the opposite direction.

Q39. Attempt either option A or B. A.

A.

I. What is meant by accommodation of the human eye?

Accommodation is the ability of the human eye lens to **change its focal length** by changing its curvature with the help of ciliary muscles so that objects at different distances can be focused clearly on the retina.

II. What is the near point of a normal eye and what does it signify? The near point of a normal human eye is:

25cm

It is the minimum distance from the eye at which an object can be seen clearly without strain.

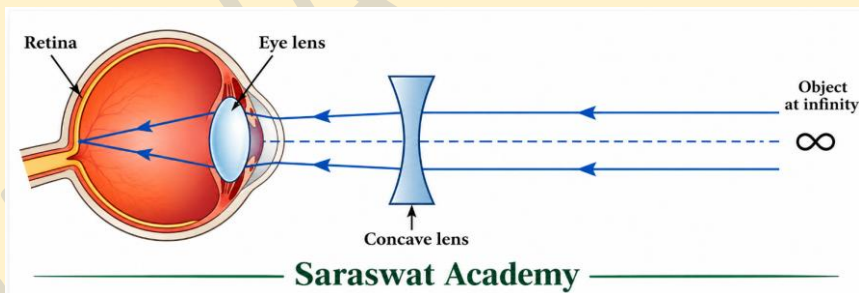
III. Name which type of lens is used to correct the defect in which a person cannot see distant objects clearly

A person who cannot see distant objects clearly has **myopia (short-sightedness)**.

It is corrected using a:

Concave lens

IV. Draw a diagram to show how the choice of your lens in (d) helps to see distant objects clearly?



Q39. Option B

I. What is dispersion of light?

Dispersion is the phenomenon of splitting of **white light into its constituent colours** when it passes through a glass prism.

The seven colours are:

Violet, Indigo, Blue, Green, Yellow, Orange and Red (VIBGYOR).

II. Which colour of light deviates the least during dispersion through a prism?

Red

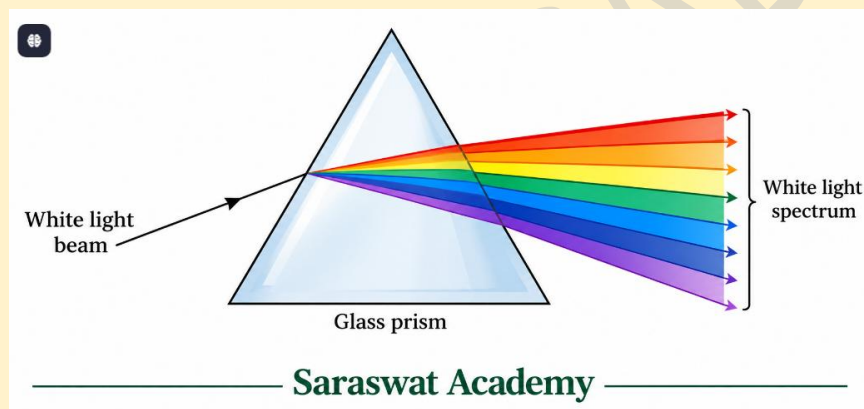
Red light has the longest wavelength among the visible colours and undergoes the least deviation in a glass prism.

III. State why the sky appears dark to an astronaut in outer space.

An astronaut in outer space does not see a blue sky because there is essentially **no atmosphere around the astronaut to scatter sunlight**.

Therefore, the sky appears **dark or black**.

IV. Draw a simple labelled diagram to show how white light splits into different colours while passing through a glass prism.



For visually impaired students

Option A

I. What is meant by hypermetropia (long-sightedness)?

Hypermetropia or long-sightedness is the defect of vision in which a person can see distant objects clearly but **cannot see nearby objects clearly**.

II. What is the far point of a normal human eye and what does it signify?

The far point of a normal human eye is:

∞

It means that a normal eye can focus parallel rays coming from a very distant object on the retina.

III. Name the type of lens used to correct hypermetropia.

Hypermetropia is corrected using a:

Convex lens

IV. Explain why a hypermetropic eye is unable to focus nearby objects on the retina.

In a hypermetropic eye, the image of a nearby object tends to form **behind the retina**.

A convex lens provides additional converging power and brings the rays together so that the image is formed on the retina.

OR

Option B

I. Why does Earth's atmosphere exhibit Tyndall's effect?

The atmosphere contains very fine particles such as dust, smoke, water droplets and gas molecules.

These particles scatter light, producing the **Tyndall effect**.

II. Which colour of light has the shortest wavelength?

Violet

III. Why do danger/stop signs use red colour?

Red light has the **longest wavelength** among visible colours and undergoes comparatively less scattering.

Therefore, it can be seen from a greater distance and through a relatively hazy atmosphere.

IV. State why the sky appears blue even though sunlight is white.

The molecules and fine particles in Earth's atmosphere scatter shorter wavelengths of sunlight more strongly than longer wavelengths.

Blue light is scattered strongly and reaches our eyes from different directions.

Therefore, the sky appears **blue**.

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