

# Sample Question Paper 03

## SCIENCE 10

Time : 3Hrs.

Max. Marks : 80

### General Instructions

- This question paper consists of 39 questions in 3 sections. Section A is Biology, Section B is Chemistry and Section C is Physics.
- All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.

### Section A

1. Which of the following is a correct combination of function and part of the digestive system? [1]  
(a) Liver- stores bile  
(b) Small intestine-Maximum absorption of water occurs  
(c) Stomach-Digestion of proteins begins here  
(d) Large intestine-Absorption of digested food takes place
2. Which of the following statements about the human digestive system are correct? [1]  
(i) The stomach produces enzymes that digest carbohydrates..  
(ii) The pancreas secretes enzymes that digest proteins and fats.  
(iii) The liver stores bile produced by the gallbladder.  
(iv) Most absorption of nutrients occurs in the small intestine.  
(v) The large intestine mainly absorbs water and forms faeces.  
(a) (i), (ii), (iv)                      (b) (ii), (iii), (v)                      (c) (i), (iv), (v)                      (d) (ii), (iv), (v)
3. Which hormone is responsible for inducing dormancy in plants? [1]  
(a) Gibberellins                      (b) Ethylene                      (c) ABA                      (d) Auxin
4. Select the correct group where all organisms exhibit Mendelian inheritance of traits. [1]  
(a) Pea plants, fruit flies, humans and butterflies  
(b) Bacteria, fungi, algae and viruses  
(c) Earthworms, tapeworms, leeches and snails  
(d) Mushrooms, mosses, ferns and algae
5. Which of the following correctly represents the function of oviduct ? [1]  
(a) Helps in capturing the released ovum and directing it into the Fallopian tube.  
(b) Provides site for implantation and supports development of the foetus.  
(c) Allows passage of sperm into the uterus and forms the birth canal during child birth.  
(d) Transports the ovum from the ovary to uterus and is the site of fertilisation.
6. Which of the following is a incorrect combination of function and part of the male reproductive system? [1]  
(a) Production of sperms: Seminal vesicles                      (b) Secretion of seminal fluid: Prostate gland  
(c) Transport of sperms: Vas deferens                      (d) Passage of urine only: Urethra

**Stage II : Proficiency Level**

7. In the given food chain, suppose the amount of energy at fifth trophic level is 50 kJ, what will be the energy available at the producer level? Grass - Grasshopper - Frog - Snake - Hawk [1]  
 (a) 50000 kJ (b) 500000 kJ (c) 500 kJ (d) 5000 kJ

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.

8. **Assertion** (A) In human beings, the respiratory pigment is haemoglobin. [1]

**Reason** (R) Haemoglobin is a type of protein which has a high affinity for  $\text{CO}_2$ .

9. **Assertion** (A) Uterus prepares itself every month to receive a fertilised egg. [1]

**Reason** (R) Ovary releases one egg every month.

10. All plants in the  $F_1$ -generation are tall when a TT pea plant is crossed with a tt pea plant. Comment upon the statement with justification. [2]

11. **Attempt either A or B.** [2]

A. Different organisms have different nervous systems to coordinate their activities.

- (i) Name the main components of the human nervous system involved in coordination.  
 (ii) How do organisms without a brain carry out coordination??

Or

B. Explain how reflex actions help protect the body from harm.

12. Plants produce their own food using sunlight. Name this process and mention the main raw materials required for it. [2]

13. Draw and explain the structure of a female reproductive system. [3]

14. In the human body, various endocrine glands secrete hormones that regulate important functions like growth, metabolism, and digestion. Some glands are closely linked to the brain and control many body activities, while others also help in digestion by releasing enzymes along with hormones. [3]

- (i) Name the endocrine glands associated with the brain along with their function.  
 (ii) Which gland secretes both digestive enzymes and hormones?

15. During exercise, the body requires more energy and the process of respiration plays a key role in providing it. Answer the following questions to understand respiration better. [4]

**Attempt either subpart A or B**

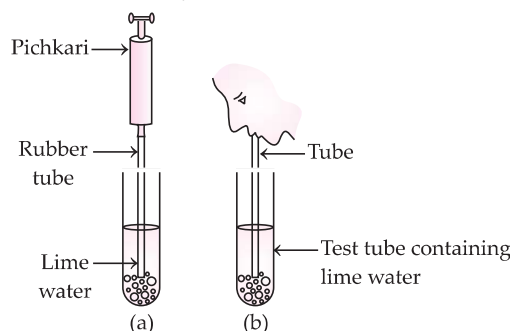
A. Where does the exchange of gases occur in human body? Describe how oxygen and carbon dioxide are exchanged.

Or

B. What happens to the diaphragm during breathing? Explain the process of inhalation and exhalation.

C. How is oxygen transported from the lungs to body cells?

D. The figure given below shows an activity. Write down the aim of this activity and the result.



**16. Attempt either A or B.**

[5]

A. Rahul saw garbage and waste dumped near a pond in his village. Such wastes can harm the water and living organisms in and around the pond.

(i) Name two types of pollutants commonly found in such wastes.

(ii) Suggest two ways to prevent water pollution.

*Or*

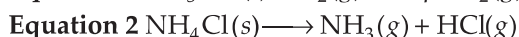
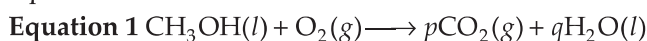
B. Neha noticed that many animals and plants are disappearing from her locality. This loss of biodiversity affects the balance of nature.

(i) What are two main reasons for the loss of biodiversity?

(ii) Why is it important to protect biodiversity?

**Section B**

**17.** Which of the following equations represent redox reactions and what are the values for ' $p$ ' and ' $q$ ' in these equations? [1]



(a) Only equation 1 is a redox reaction,  $p = 1$  and  $q = 2$

(b) Both equations 1 and 2 are redox reactions,  $p = 1$  and  $q = 2$

(c) Only equation 2 is a redox reaction,  $p = 1$  and  $q = 2$

(d) Neither equation 1 nor 2 is a redox reaction

**18.** Four statements about acids and bases are listed below. [1]

I. Acids furnish  $\text{H}^+$  ions in aqueous solution while bases furnish  $\text{OH}^-$  ions.

II. Acids turn phenolphthalein pink and bases make it colourless.

III. Acids turn blue litmus red, while bases turn red litmus blue.

IV. Sodium hydroxide solution furnishes  $\text{H}^+$  ions in water.

Which statements are correct?

(a) I and II

(b) I and III

(c) II and IV

(d) III and IV

**19.** A strip of zinc metal is added to each of the two test tubes ' $P$ ' and ' $Q$ ' containing aqueous copper (II) sulphate and aqueous aluminium sulphate respectively. Which of the following observations is correct? [1]

(a) In test tube ' $P$ ' a reddish-brown deposit is seen, and in test tube ' $Q$ ' there is no reaction.

(b) In test tube ' $P$ ' no reaction is seen, and in test tube ' $Q$ ' a grey deposit is seen.

(c) No reaction takes place in either of the test tubes.

(d) A grey coating appears in both test tubes.

**20.** The oxides of a metal and a non-metal are separately dissolved in water. The pH of each solution is noted as follows. Which sample shows the correct pH values? [1]

Sample	Metal oxide solution pH	Non-metal oxide solution pH
(a)	2	12
(b)	12	2
(c)	7	7
(d)	12	7

**21.** Which of the following will not contain a covalent double bond between its atoms? [1]

(a)  $\text{H}_2$

(b)  $\text{O}_2$

(c)  $\text{NaCl}$

(d)  $\text{Cl}_2$

**22.** When plaster of Paris is left open in moist air for a long time, it hardens because [1]

(a) plaster of Paris combines with  $\text{CO}_2$  to form  $\text{CaCO}_3$ .

(b) plaster of Paris changes to gypsum by absorbing moisture.

(c) plaster of Paris changes to quicklime by absorbing moisture.

(d) plaster of Paris reacts with moisture to form slaked lime.

23. In the reaction of aqueous solution of silver nitrate with aqueous solution of sodium chloride, the aqueous solution formed will be [1]

(a) AgCl (b) NaNO<sub>3</sub> (c) NaCl (d) AgNO<sub>3</sub>

The following question consists of two statements - **Assertion (A)** and **Reason (R)**. Answer the question by selecting the appropriate option given below.

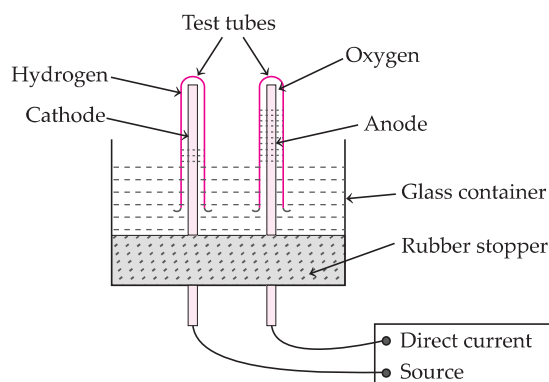
- (a) Both (A) and (R) are true, and (R) is the correct explanation of (A).  
(b) Both (A) and (R) are true, but (R) is not the correct explanation of (A).  
(c) (A) is true, but (R) is false.  
(d) (A) is false, but (R) is true.

24. **Assertion (A)** HCl produces hydronium ions (H<sub>3</sub>O<sup>+</sup>) and chloride ions (Cl<sup>-</sup>) in aqueous solution. [1]

**Reason (R)** In the presence of water, bases give H<sup>+</sup> ions.

25. The following activity is set up in the science lab by the teacher. [2]

He connected two test tubes inverted over the electrodes of a beaker containing acidified water and connected the electrodes to a battery. Students observed the gas bubbles collected in the test tubes during electrolysis of water.



- (a) If the teacher replaces acidified water with pure water, will the students' observation change? Justify your answer.  
(b) Is the electrolysis of water an endothermic reaction? Give reason for your answer.

26. **Attempt either A or B.** [3]

A. (i) When methane is treated with chlorine gas in the presence of sunlight, a compound 'X' is formed along with hydrogen chloride. Identify compound 'X'. Why is sunlight necessary for this reaction to occur?

(ii) Name the type of reaction taking place in this process.

Or

B. (i) When an organic compound 'Y' is oxidised with alkaline KMnO<sub>4</sub> or acidified K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>, acetic acid is formed. Identify compound 'Y'.

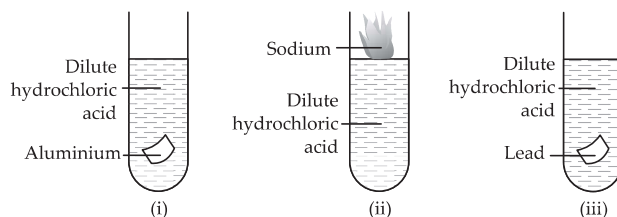
(ii) State one physical property of compound 'Y' that distinguishes it from hydrocarbons.

(iii) Name the type of functional group present in compound 'Y'.

27. During a laboratory experiment, a student compared the reactivity of aluminium, sodium, and lead with dilute hydrochloric acid. [3]

She added small pieces of each metal into separate test tubes containing HCl and observed.

- Aluminium caused the solution to heat up.
- Sodium reacted vigorously with flames.
- Lead produced bubbles slowly.



Answer the following questions based on the information given above.

- Explain the reason for the rise in temperature when aluminium reacts with dilute HCl.
- Give a reason why the reaction of sodium with dilute HCl is extremely vigorous.
- State why the reaction of lead with dilute HCl is slow and produces only a few bubbles.

**28.** Riya took different solutions and tested them with blue litmus, red litmus, and phenolphthalein indicators. Her observations are recorded in the table below. [4]

Sample solution	Blue litmus	Red litmus	Phenolphthalein
<i>P</i>	Red	No change	Colourless
<i>Q</i>	No change	Blue	Pink
<i>R</i>	No change	No change	Colourless

Answer the following questions based on the above information:

A. Identify the nature (acidic, basic, or neutral) of solution *P* and *R*.

- P* = acidic; *R* = neutral
- P* = basic; *R* = acidic
- P* = neutral; *R* = basic

Justify your answer.

B. Riya mixed solution *P* and solution *Q* in a test tube.

- What type of reaction will take place?
- Write an example of the balanced chemical equation for the reaction.

Or

Riya sodium hydroxide solution dropwise to dilute hydrochloric acid containing phenolphthalein. What colour change will be observed and why? Name the type of reaction.

C. Which of the following statements is true about the reaction between *P* and *Q* and why?

- It is neutralisation and double displacement reaction.
- It is neutralisation and precipitation reaction.
- It is precipitation and double displacement reaction.
- It is neutralisation, double displacement and precipitation reaction.

**29.** Attempt either A or B. [5]

A. A hydrocarbon '*X*' with molecular formula  $C_2H_4$  shows the following properties:

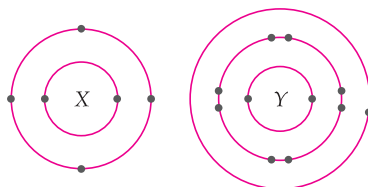
- It decolourises bromine water.
- On combustion, it forms  $CO_2$  and  $H_2O$ .

Answer the following questions:

- Identify the type of hydrocarbon (alkane/alkene/alkyne) and justify your answer.
- Write the IUPAC name and draw the electron dot structure of this compound.
- Name the compound obtained when this hydrocarbon reacts with hydrogen in the presence of a catalyst.
- Write the chemical equation for the combustion of this hydrocarbon.
- Name the alcohol that gives this hydrocarbon on dehydration with concentrated  $H_2SO_4$ .

Or

B. The electronic configuration of elements X (2, 4) and Y (2, 8, 1) is given.



Based on the information given above, answer the following questions:

- Which type of bond is formed between X and Y? Explain with reason.
- How many valence electrons take part in the bond formation between X and Y? Explain.
- Give the chemical formula of the compound.
- State one physical property of this compound based on the type of bonding.
- Write the chemical equation for the reaction of Y with ethanoic acid.

### Section C

30. While studying Ohm's law, Ananya measured current in a circuit and noted the following statements: [1]

- The current through a conductor is directly proportional to the potential difference across its ends at constant temperature.
- Resistance of a conductor decreases with increase in temperature for metallic conductors.
- The slope of  $V$ - $I$  graph gives the reciprocal of resistance.

Choose from the following the correct option that lists the correct statements about Ohm's law:

- (a) I and II                      (b) I and III                      (c) II and III                      (d) I, II and III

31. Choose the correct option from the below which explains why a coin at the bottom of a water-filled beaker appears raised when viewed from above? [1]

- Light rays bend towards the normal on entering water, making the coin appear raised.
- Light rays bend away from the normal on leaving water to air, causing the apparent depth to be less than real depth.
- The water magnifies the size of the coin, making it appear raised.
- The refractive index of water is less than air, making the coin seem closer.

The following question consist of two statements – **Assertion (A)** and **Reason (R)**. Answer the question by selecting the appropriate option given below.

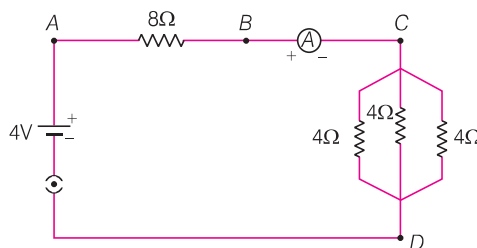
- Both (A) and (R) are true, and (R) is the correct explanation of (A).
- Both (A) and (R) are true, but (R) is not the correct explanation of (A).
- (A) is true, but (R) is false.
- (A) is false, but (R) is true.

32. **Assertion (A)** Magnetic field never intersects each other. [1]

**Reason (R)** If two magnetic field lines intersect, it would imply two different directions of the magnetic field at that point.

33. Attempt either A or B. [2]

A.

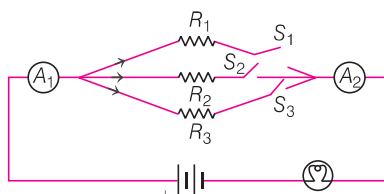


Find out the following in the electric circuit given in the figure.

- Current flowing through  $8\Omega$  resistor
- Potential difference across  $8\Omega$  resistor

Or

- B. The circuit shown below has a bulb, three resistors  $R_1$ ,  $R_2$  and  $R_3$  and three switches  $S_1$ ,  $S_2$  and  $S_3$ . There are also two ammeters  $A_1$  and  $A_2$  in the circuit.

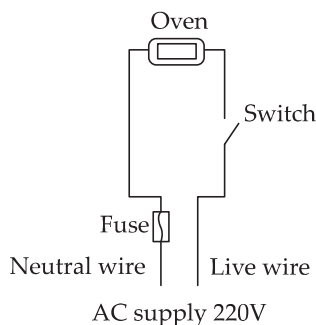


What will be reading on ammeter  $A_2$  compare with the reading on  $A_1$  when

- all the three switches are closed?
- one switch is closed?

34. In the diagram below,

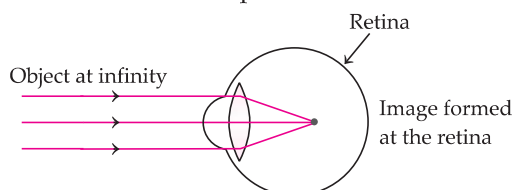
[2]



- In case of an overload, will the fuse protect the electric oven from damage?
- If the oven has a rating of 13 A, what should be the minimum rating of the fuse?
- Name two important characteristics of this wire.

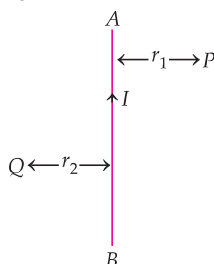
35. Study the diagram given below and answer the question that follow

[3]



- Name the defect of vision represented in the diagram.
- Redraw the diagram and show how a corrective lens resolves this defect? Label the lens type and focal point.

36. A current-carrying conductor produces circular magnetic field lines around it. The field's direction is given by the right-hand thumb rule and its strength decreases with distance. [3]





- (i) For the current-carrying conductor  $AB$  in the plane of the paper, state the directions of magnetic fields at points  $P$  and  $Q$ .
- (ii) If distances are  $r_1$  and  $r_2$  with  $r_1 > r_2$ , at which point is the magnetic field stronger? Why?

**37.** An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm. [3]

- (i) Use lens formula to find the distance of the image from the lens.
- (ii) List four characteristics of the image (nature, position, size, erect/inverted) formed by the lens in this case.

**38.** Rohan studied that an electric bulb consists of a filament made of a metal with a high melting point, such as tungsten. Answer the following: [4]

- A. Name the gas filled in the bulbs to prolong the life of the filament.
- B. A current of 5 A is drawn by the filament of an electric bulb. How much charge flows through it in 30 s?

**Attempt either subpart C or D.**

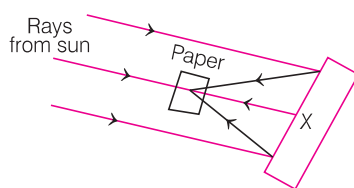
- C. Using the rating 40 W-220 V of an electric bulb. Calculate the resistance of the bulb's filament.

Or

- D. Calculate the current drawn by the bulb when operated at 220 V.

**39.** **Attempt either A or B.** [5]

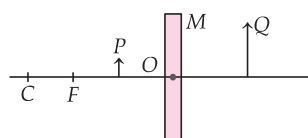
- A. On a sunny day, Ravi saw his younger brother trying to look at the Sun's reflection in a mirror. He immediately warned him that it can be harmful to the eyes and explained how the image formed by the mirror can focus strong sunlight into the eye.



- (i) Identify the optical object  $X$ .
- (ii) Distinguish between a concave mirror and a convex mirror.
- (iii) A concave mirror is used to focus sunlight onto a piece of paper. If the distance between the mirror and the point where the paper starts to burn is 15 cm, calculate the focal length of the mirror and the radius of curvature.

Or

- B. In the diagram,  $M$  is a mirror and  $P$  is an object whose magnified image  $Q$  is formed by the mirror.



- (i) State the type of mirror  $M$  and one property of image  $Q$ .
- (ii) A 6 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 25 cm at a distance of 40 cm. Calculate the position of the image formed and size of the image formed.
- (iii) If the object in (ii) is moved closer to the lens at 20 cm, predict qualitatively (without calculation) the nature and position of the new image.



# Solutions

1. (c) Stomach- Digestion of protein begins here is the correct combination as stomach produces enzymes like pepsin that start the digestion of proteins.
2. (d) The statements (ii), (iv) and (v) are correct because the pancreas produces enzymes like trypsin and lipase which digests proteins and fats, most nutrient absorption happens in the small intestine, and the large intestine absorbs water and forms faeces.
3. (c) Absciscic acid (ABA) induces dormancy in plants by inhibiting growth and helping them to survive in unfavorable conditions.
4. (a) Pea plants, fruit flies, humans and butterflies belong to the same group as all of them reproduce sexually and Mendelian inheritance only implies to sexually reproducing organisms.

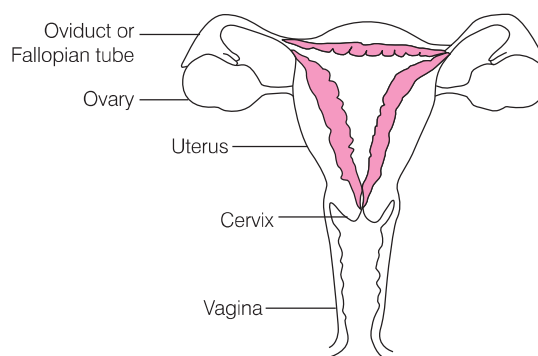
## Mistake Alert

Don't get confuse with other options, as some organisms reproduce asexually, which does not follow Mendelian inheritance.

5. (d) Oviduct carries the ovum from the ovary to the uterus and is the site where fertilisation takes place.
6. (a) Transport of sperms : Vas deferens is the correct combination as Vas deferens transports sperms from the testes to the urethra.
7. (b) Energy decreases by about 90% at each trophic level, so energy at producer level =  $50 \text{ kJ} \times 10^4$   
 $= 500000 \text{ kJ}$ .
8. (c) A is true, but R is false. R can be corrected as Haemoglobin has a high affinity for carbon monoxide.
9. (a) Both A and R are true and R is the correct explanation of A.
10. When a pure tall pea plant (TT) is crossed with a pure short pea plant (tt), all the  $F_1$  offspring are tall because the tall trait (T) is dominant over the short trait (t). The  $F_1$  plants have the genotype Tt, which means they carry one tall and one short allele, but they show the tall phenotype due to the dominance of the tall allele. Thus, all plants in the  $F_1$ -generation are tall.
11. A. (i) The main components of the human nervous system involved in coordination are the brain, spinal cord and nerves. [1]  
 (ii) Organisms like *Hydra* do not have a brain or spinal cord therefore coordination in such organisms takes place through simple nerve cells spread throughout the body. [1]  
 Or  
 B. Reflex actions helps to protect the body by enabling immediate and automatic responses to harmful stimuli without involving the brain.

When a harmful stimulus is detected, sensory neurons send impulses to the spinal cord, which quickly sends a signal through motor neurons to muscles to produce a quick action, such as pulling your hand away from a hot object. This rapid response minimises injury and helps keep the body safe. [2]

12. The process by which plants like trees and grass make their own food using sunlight is called photosynthesis. During photosynthesis, plants use carbon dioxide from the air and water from the soil as raw materials. Using sunlight, they convert these into glucose (food) and release oxygen. This process is essential for plants to produce energy and also supports other organisms in the ecosystem.
13. The female reproductive system consists of two ovaries, two Fallopian tubes, one uterus, and one vagina. The ovaries produce eggs (ova) and female hormones. The eggs are released from the ovaries and travel through the Fallopian tubes, where fertilisation can occur if sperm is present. The fertilised egg then moves to the uterus, where it gets implanted and develops into a baby. The vagina connects the uterus to the outside and serves as the birth canal. [1½]



Female reproductive system

[1½]

## ★ Value Point

To get the maximum marks draw a neat and clean diagram with every part properly labelled.

14. (i) The endocrine glands associated with the brain are the hypothalamus and pituitary gland. The hypothalamus controls the pituitary gland and helps regulate body temperature, hunger and thirst. The pituitary gland is called the "master gland" because it controls many other endocrine glands and regulates growth and reproduction. [2]

- (ii) The pancreas secretes both digestive enzymes and hormones. It produces enzymes that help digest food and hormones like insulin and glucagon that regulate blood sugar levels. [1]

15. A. The exchange of gases takes place in the alveoli of the lungs. Oxygen from the air passes into the blood, and carbon dioxide from the blood passes into the alveoli to be removed. [2]

Or B. The diaphragm is a muscle below the lungs. When we breathe in, it moves down to help air enter the lungs. When we breathe out, it moves up to push air out.

C. Oxygen is carried by the blood to all body parts with the help of haemoglobin in red blood cells. [1]

D. The given activity demonstrates the presence of carbon dioxide ( $\text{CO}_2$ ) in exhaled air. When air is blown through the rubber tube into the test tube containing lime water, the lime water turns milky confirming the presence of carbon dioxide in exhaled air. [1]

16. (A) (i) Garbage dumped near ponds usually contains two types of pollutants - biodegradable and non-biodegradable waste. Biodegradable waste includes materials like food scraps, leaves and paper which can decompose naturally. Non-biodegradable waste includes plastic, glass and metals which do not decompose easily and cause long-term pollution. Both types of waste harm the water quality and living organisms in the pond. [2½]

(ii) To prevent water pollution, people should avoid throwing waste directly into water bodies. Proper disposal methods like segregating waste into biodegradable and non-biodegradable should be followed. Biodegradable waste can be composted, while non-biodegradable waste should be recycled or sent to landfills. Planting trees and creating awareness about cleanliness near water bodies also helps protect the environment from pollution. [2½]

Or

B. (i) The main reasons for loss of biodiversity are habitat destruction and pollution. Habitat destruction happens when forests are cut down, wetlands are drained and land is converted for farming or construction. This destroys the homes of many plants and animals. Pollution from industries, vehicles, and human activities contaminates air, water, and soil, making it difficult for living organisms to survive.

(ii) It is important to protect biodiversity because it helps to maintain the balance of nature. Different plants and animals depend on each other for food, shelter and survival.

Biodiversity also provides us with essential resources like food, medicines, and raw materials. Conserving biodiversity ensures that ecosystems remain healthy and sustainable for future generations.

17. (a) Only equation 1 is a redox reaction,  $p = 1$  and  $q = 2$ . In  $\text{CH}_3\text{OH}$ , C is oxidised from  $-2$  to  $+4$  in  $\text{CO}_2$ , and  $\text{O}_2$  is reduced from  $0$  to  $-2$  in  $\text{H}_2\text{O}$ . Hence it is a redox reaction.

$\text{NH}_4\text{Cl} \longrightarrow \text{NH}_3 + \text{HCl}$  is only a decomposition reaction with no change in oxidation states. Hence, it is not a redox reaction.

18. (b) I and III. Acids release  $\text{H}^+$  ions and bases release  $\text{OH}^-$  ions in aqueous solutions. Bases turn phenolphthalein pink, and acids turn blue litmus red.

19. (a) In test tube 'P' a reddish-brown deposit is seen, and in test tube 'Q' there is no reaction. Zinc displaces copper from copper sulphate as it is more reactive, but it cannot displace aluminium from aluminium sulphate.

#### ★ Value Point

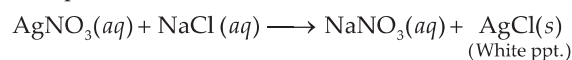
The reactivity series is a list of metals in decreasing order of reactivity towards water and dilute acids. K, Na, Ca are highly reactive, while Cu, Ag, Au are least reactive. A more reactive metal displaces a less reactive metal from its salt solution.

20. (b) Metal oxides form basic solutions ( $\text{pH} > 7$ ), while non-metal oxides form acidic solutions ( $\text{pH} < 7$ ) in water.

21. (c)  $\text{NaCl}$  is an ionic compound, while  $\text{O}_2$  has a double bond and  $\text{H}_2$ ,  $\text{Cl}_2$  have single covalent bonds.

22. (b) Plaster of Paris changes to gypsum by absorbing moisture.

23. (b)  $\text{NaNO}_3$ ,  $\text{AgCl}$  forms as a white precipitate, and the aqueous solution contains sodium nitrate.



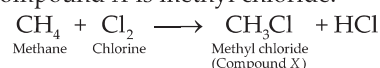
24. (c) A is true, but R is false. R can be corrected as  $\text{HCl}$  produces  $\text{H}^+$  ions in aqueous solution because in the presence of water, acids give  $\text{H}^+$  ions.

As  $\text{H}^+$  ions cannot exist alone so, it combines with water molecules and form  $\text{H}_3\text{O}^+$ .

25. (a) Yes, the observation will change. Pure water is a poor conductor of electricity, so almost no gas will be collected. [1]

(b) Yes, electrolysis of water is endothermic as electric energy is absorbed to split water into hydrogen and oxygen. [1]

26. A. (i) Compound X is methyl chloride.

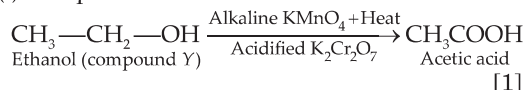


Sunlight is necessary because it provides energy to break the  $\text{Cl}_2$  molecule into free radicals. [2]

- (ii) The type of reaction taking place is a substitution reaction, where one hydrogen atom of methane is replaced by chlorine. [1]

Or

- B. (i) Compound Y is ethanol.



[1]

- (ii) Ethanol is a liquid, miscible with water and has a characteristic smell, unlike hydrocarbons which are insoluble in water. [1]

- (iii) The functional group present in compound 'Y' is the  $-\text{OH}$  (hydroxyl) group of alcohols. [1]

27. (a) The temperature rises because aluminium reaction with dilute HCl in an exothermic reaction, releasing heat along with hydrogen gas. [1]

- (b) Sodium reacts extremely vigorously with HCl because it is highly reactive, producing hydrogen gas rapidly with heat that can ignite the gas and causing a vigorous reaction. [1]

- (c) Lead reacts slowly with dilute HCl because it is less reactive, so hydrogen gas is released gradually, forming only a few bubbles. [1]

28. A. (a) Solution P is acidic because it turns blue litmus red and keeps phenolphthalein colourless. Solution R is neutral because it does not affect either litmus paper or phenolphthalein. [1]

- B. (a) When solution P (acid) is mixed with solution Q (base), a neutralisation reaction takes place because an acid reacts with a base to form salt and water.

- (b) The balanced chemical equation for this reaction is



Or

When sodium hydroxide is added dropwise to dilute hydrochloric acid containing phenolphthalein, the colour changes from colourless to pink because phenolphthalein is pink in a basic medium. The reaction is a neutralisation reaction as an acid reacts with a base to form salt and water. [1]

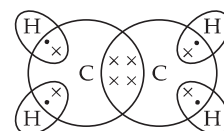
- C. The correct statement is (a) It is neutralisation and double displacement.

This is because  $\text{H}^+$  ions from the acid combine with  $\text{OH}^-$  ions from the base to form water, and the cations and anions of the two reactants are exchanged, which is a double displacement reaction. No precipitate is formed, so the other options are incorrect. [2]

29. A. (a) The hydrocarbon  $\text{C}_2\text{H}_4$  is an alkene because it contains a double bond and decolourises bromine water, which is the characteristic test for unsaturated hydrocarbons. [1]

- (b) The IUPAC name of the compound is ethene.

The electron dot structure of ethene shows two carbon atoms joined by a double bond and each bonded to two hydrogen atoms.



Electron dot structure of ethene ( $\text{C}_2\text{H}_4$ )

[1]

- (c) When ethene reacts with hydrogen in the presence of nickel catalyst, it forms ethane, which is a saturated hydrocarbon. [1]

- (d) The combustion reaction of ethene is



- (e) The alcohol that produces ethene on dehydration with concentrated  $\text{H}_2\text{SO}_4$  is ethanol ( $\text{C}_2\text{H}_5\text{OH}$ ). [1]

Or

- B. (a) The bond formed between X and Y is a covalent bond, because element X (carbon) shares its valence electrons with element Y (hydrogen-like or sodium) to achieve a stable configuration. [1]

- (b) Four valence electrons from X and one valence electron from Y participate in bond formation, as X needs to share electrons to complete its octet. [1]

- (c) The chemical formula of the compound is  $\text{XY}_4$ , as X forms four single bonds with four Y atoms. [1]

- (d) The compound is generally a poor conductor of electricity because covalent compounds do not have free ions or electrons to conduct current. [1]

- (e) When element Y (like Na) reacts with ethanoic acid ( $\text{CH}_3\text{COOH}$ ), hydrogen gas is evolved, and the salt sodium ethanoate is formed.



30. (b) I and III

Current  $\propto$  voltage at constant temperature; slope of V-I graph =  $\frac{1}{R}$

31. (b) Light bends away from the normal as it travels from water to air, reducing the apparent depth, which makes submerged objects appear raised.

32. (a) Both A and R are true and R is the correct explanation of A.

Magnetic field lines do not intersect each other because if they did, it would mean that at the point of intersection, the magnetic field has two different directions, which is impossible.

33. A. (i) The equivalent resistance

$$\frac{1}{R_p} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4}$$

$$R_p = \frac{4}{3}$$

$$R_{eq} = \frac{4}{3} + 8 = \frac{4+24}{3} = \frac{28}{3} \Omega$$

$$\text{Current, } I = \frac{V}{R} = \frac{4}{28/3} = \frac{3}{7} \text{ A}$$

- (ii) Potential difference,

$$V_{AB} = R \times I = 8 \times \frac{3}{7} = \frac{24}{7} \text{ V}$$

Or

- B. (i) The reading on ammeter
- $A_2$
- will be the same as the reading on ammeter
- $A_1$
- . [1]

- (ii) The reading on ammeter
- $A_2$
- will be equal to the reading on ammeter
- $A_1$
- . [1]

34. (i) No, if the fuse in the neutral wire, the live wire remains connected to the oven. During overloading, current can still reach the oven, so it won't be protected. [1/2]

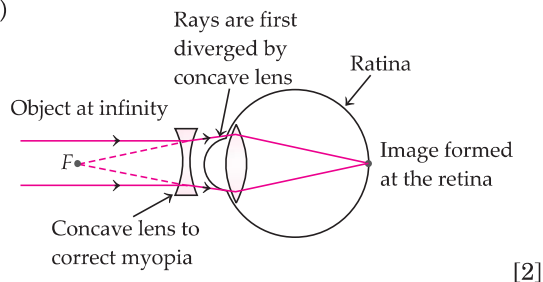
- (ii) The rating of an electric fuse should be 13 A or above, so that if the circuit is overload above 13 A, which is the current rating, then electric fuse burns and cuts off the circuit. [1/2]

- (iii) Characteristics of fuse wire [1]

- (i) High resistivity
- 
- (ii) Low melting point

35. (i) Myopia [1]

- (ii)



## ★ Value Point

To get the maximum marks draw the neat and clean diagram with every part labelled in the diagram.

36. (i) According to the right-hand thumb rule, magnetic field at point
- $P$
- into the paper and at point
- $Q$
- is out of the paper. [1]

- (ii) In the case of
- $r_1$
- , the direction of the magnetic field is into the paper, and in the case of
- $r_2$
- , it is out of the paper. Since
- $r_1 > r_2$
- , the point
- $P$
- is farther from the wire than point
- $Q$
- .

Therefore, the strength of the magnetic field at point  $P$  is less than that at point  $Q$ , because magnetic field strength decreases with distance from the conductor. [2]

37. (i) Given,
- $u = -60 \text{ cm}$
- ,
- $f = -30 \text{ cm}$

By lens formula,  $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ 

$$\Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{-30} + \frac{1}{-60} = \frac{2+1}{-60} = -\frac{1}{20}$$

$$\Rightarrow v = -20 \text{ cm} \quad [2]$$

- (ii) Since,
- $v$
- is negative, therefore image is formed at same side of the object.

Nature of image is virtual, erect and diminished and image is formed between focus and optical centre. [1]

38. A. The gas filled in the bulb is argon (or a mixture of argon and nitrogen). [1]

- B. Calculation
- $Q = I \times t = 5 \text{ A} \times 30 \text{ s} = 150 \text{ C}$

Charge flowed = 150 C [1]

- C. Given power (
- $P$
- ) = 40 W, Voltage (
- $V$
- ) = 220 V

$$\text{Formula: } P = \frac{V^2}{R} \Rightarrow R = \frac{V^2}{P}$$

Substitute values:

$$R = \frac{(220)^2}{40} = \frac{48400}{40} = 1210 \Omega \quad [2]$$

Or

- D. Formula:
- $P = V \times I \Rightarrow I = \frac{P}{V}$

Substitute values:

$$I = \frac{40 \text{ W}}{220 \text{ V}} = \frac{4}{22} = \frac{2}{11}$$

$$\approx 0.182 \text{ A} \quad [2]$$

39. A. (i) The optical object
- $X$
- is the concave mirror. [1]

Feature	Concave Mirror	Convex Mirror
Reflecting Surface	Curved inward (like a cave)	Curved outward (bulging)
Light behaviour	Converges light rays (brings rays together)	Diverges light rays spread rays apart
Focal point	Real (in front of the mirror)	Virtual (behind the mirror)

- (iii) Focal length (
- $f$
- ) = 15 cm

Radius of curvature ( $R$ ) is related to the focal length by  $R = 2f$

$$\text{Substitute } f = 15 \text{ cm } R = 2 \times 15 = 30 \text{ cm} \quad [2]$$

Or

- B. (i) The given mirror  $M$  is a concave mirror, and its property is that the image formed is virtual. [2]

(ii) Given,

Focal length,  $f = 25$  cm (positive for convex lens)

Object distance,  $u = -40$  cm (negative by sign convention)

Object height,  $h = 6$  cm

**Lens Formula**

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{25} - \frac{1}{40} = \frac{40 - 25}{1000} = \frac{15}{1000} = \frac{3}{200}$$

$$v = \frac{200}{3} \approx 66.7 \text{ cm (real image on the other side)}$$

**Mistake Alert**

Student often substitute distances directly without using sign convention.

**Magnification ( $m$ )**

$$m = \frac{v}{u} = \frac{66.7}{-40} = -1.67$$

**Image height ( $h'$ )**

$$h' = m \times h = -1.67 \times 6 \approx -10 \text{ cm}$$

So, image is 10 cm tall, real, and inverted. [2]

- (iii) When the object is at 20 cm, (less than the focal length of 25 cm), the image formed will be virtual, erect and magnified, located on the same side of the lens as the object. [1]

## My Reflection & Problem Points

Write down any difficulties, doubts, or mistakes you faced in this paper.

Discuss these points with your teacher and sort them out.

Concept(s) I got stuck on .....

.....

Question(s) I couldn't complete .....

.....

What confused me most .....

.....

Time issue faced in .....