

PRACTICE PAPER 01 (2026-27)
CHAPTER 03: METALS AND NON-METALS
(STEP-BY-STEP SOLUTIONS)

SUBJECT: SCIENCE

MAX. MARKS : 40

CLASS : X

DURATION : 1½ hrs

General Instructions:

- (i) All questions are compulsory.
- (ii) This question paper contains **20** questions divided into five Sections A, B, C, D and E.
- (iii) **Section A** comprises 10 MCQs and Assertion-Reason questions of **1 mark** each. **Section B** comprises 4 Very Short Answer questions of **2 marks** each. **Section C** comprises 3 Short Answer questions of **3 marks** each. **Section D** comprises 1 Long Answer question of **5 marks**. **Section E** comprises 2 Case Study Based questions of **4 marks** each.
- (iv) There is no overall choice. Internal choice is provided in Section E.
- (v) Use of calculators is not permitted.

SECTION - A

Questions 1 to 10 carry 1 mark each.

1. Which of the following metals exists as a liquid at room temperature?

- | | |
|-------------|-------------|
| (a) Gallium | (b) Mercury |
| (c) Bromine | (d) Caesium |

Solution:

Ans: (b) Mercury

- All metals except mercury are solids at room temperature. Gallium and caesium have low melting points but are solids; bromine is a liquid **non-metal**.

2. Which of the following non-metals is lustrous?

- | | |
|----------------|-------------|
| (a) Iodine | (b) Sulphur |
| (c) Phosphorus | (d) Coal |

Solution:

Ans: (a) Iodine

- Non-metals are usually dull, but iodine is an exception: it is a non-metal with lustre.

3. Which one of the following is an amphoteric oxide?

- | | |
|------------------------------------|---------------------|
| (a) Na ₂ O | (b) MgO |
| (c) Al ₂ O ₃ | (d) SO ₂ |

Solution:

Ans: (c) Al₂O₃

- Aluminium oxide reacts with both acids and bases to give salt and water:



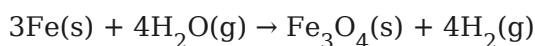
- Na₂O and MgO are basic; SO₂ is acidic.

4. A metal does not react with cold water or hot water, but reacts with steam to form a metal oxide and hydrogen. The metal is

- | | |
|---------------|-------------|
| (a) Sodium | (b) Calcium |
| (c) Magnesium | (d) Iron |

Solution:

Ans: (d) Iron



- Na reacts violently with cold water, Ca with cold water (less violently), Mg with hot water.

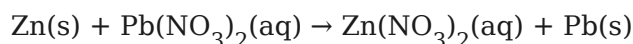
5. In which of the following will a displacement reaction take place?

- (a) Zinc in aluminium sulphate solution (b) Zinc in lead nitrate solution
(c) Copper in iron(II) sulphate solution (d) Lead in zinc sulphate solution

Solution:

Ans: (b) Zinc in lead nitrate solution

- A metal displaces only a metal **below** it in the reactivity series. Zn is above Pb, so it displaces lead.



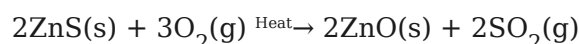
- In (a), (c) and (d) the metal added is less reactive than the metal in the salt, so no reaction occurs.

6. Zinc blende (ZnS) is converted into zinc oxide before reduction by heating it strongly in excess air. This process is called

- (a) calcination
(b) roasting
(c) electrolytic refining
(d) thermit process

Solution:

Ans: (b) roasting



- Sulphide ores are roasted (excess air); carbonate ores are calcined (limited air).

7. In the electrolytic refining of copper, the impure copper is made the

- (a) cathode
(b) anode
(c) electrolyte
(d) anode mud

Solution:

Ans: (b) anode

- Impure metal = anode; thin strip of pure metal = cathode; acidified copper sulphate solution = electrolyte. Pure copper deposits on the cathode.

8. Ornaments in India are generally made of 22 carat gold. This means the ornament contains

- (a) 22 parts pure gold and 2 parts copper or silver
(b) 22% gold and 78% copper
(c) 2 parts gold and 22 parts silver
(d) pure gold with 22 g of copper

Solution:

Ans: (a) 22 parts pure gold and 2 parts copper or silver

- Pure (24 carat) gold is too soft for jewellery, so it is alloyed with copper or silver to make it hard.

In the following questions 9 and 10, a statement of Assertion (A) is followed by a statement of Reason (R). Mark the correct choice as:

- (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.

9. Assertion (A): Sodium and potassium metals are stored immersed in kerosene oil.

Reason (R): Sodium and potassium react so vigorously with oxygen that they catch fire if kept in the open.

Solution:

Ans: (a)

- Both are true and R explains A: kerosene keeps air and moisture away and prevents accidental fires.

10. Assertion (A): Solid sodium chloride conducts electricity.

Reason (R): Ionic compounds are made of oppositely charged ions held by strong electrostatic forces.

Solution:

Ans: (d)

- (A) is false: in the solid, the ions are fixed in a rigid structure and cannot move, so it does not conduct. (R) is a true statement.

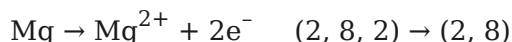
SECTION - B

Questions 11 to 14 carry 2 marks each.

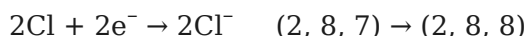
11. Show the formation of magnesium chloride by the transfer of electrons, writing the electronic configuration of each atom and ion. Name the cation and anion present in it. (Atomic numbers: Mg = 12, Cl = 17)

Solution:

Step 1: Mg (2, 8, 2) loses its 2 valence electrons to attain the stable configuration of neon.



Step 2: Each Cl (2, 8, 7) gains one electron. Two Cl atoms take the two electrons.



Step 3: The oppositely charged ions attract to form MgCl_2 ($\text{Mg}^{2+} 2\text{Cl}^-$). [1½]

Cation: **magnesium ion, Mg^{2+}** ; anion: **chloride ion, Cl^-** . [½]

12. A piece of calcium is dropped into a beaker of cold water.

(a) Write the balanced equation for the reaction.

(b) Why does calcium start floating? Why does the hydrogen evolved not catch fire, as it does with sodium?

Solution:

(a)



[1 mark]

(b) Bubbles of hydrogen gas **stick to the surface** of calcium and make it float. [½] The reaction is less violent than that of sodium, so the **heat evolved is not enough** for hydrogen to catch fire. [½]

13. (a) Why is hydrogen gas usually not evolved when a metal reacts with nitric acid? Name two metals that do give hydrogen with very dilute nitric acid.

(b) What is aqua regia? State one special property of it.

Solution:

(a) HNO_3 is a **strong oxidising agent**; it oxidises the H_2 produced to water and is itself reduced to oxides of nitrogen (N_2O , NO , NO_2). **Magnesium (Mg)** and **manganese (Mn)** give H_2 with very dilute HNO_3 . [½ + ½]

(b) Aqua regia is a freshly prepared mixture of **concentrated HCl and concentrated HNO_3 in the ratio 3 : 1**. [½] It can **dissolve gold and platinum**, which neither acid can do alone. [½]

14. (a) Why is pure iron not used for making articles? How is stainless steel different from iron?
(b) Why is solder used for joining electrical wires, while copper and not brass is used for making electrical circuits?

Solution:

(a) Pure iron is **very soft and stretches easily when hot**. [$\frac{1}{2}$] Stainless steel is an alloy of iron with **nickel and chromium**; it is hard and does not rust. [$\frac{1}{2}$]

(b) Solder (alloy of Pb and Sn) has a **low melting point**, so it melts easily to weld wires. [$\frac{1}{2}$]
Alloys like brass are poorer conductors of electricity than pure copper, so **copper** is preferred for circuits. [$\frac{1}{2}$]

SECTION - C

Questions 15 to 17 carry 3 marks each.

15. Zinc occurs in nature as zinc blende (ZnS) and calamine (ZnCO₃).

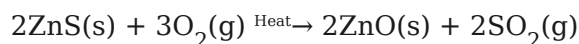
(a) Why are these ores first converted into zinc oxide? Name the process used for each ore and write the equations.

(b) How is zinc obtained from zinc oxide? Write the equation and identify the reducing agent.

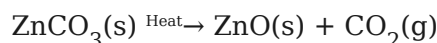
Solution:

(a) It is easier to obtain a metal from its **oxide** than from its sulphide or carbonate. [$\frac{1}{2}$]

Zinc blende - **roasting** (heating strongly in excess air):

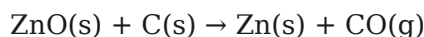


Calamine - **calcination** (heating strongly in limited air):



[$\frac{1}{2}$ + $\frac{1}{2}$ for the two processes with equations]

(b) Zinc oxide is heated with carbon (coke):



Reducing agent: **carbon** (it removes oxygen from ZnO and is itself oxidised to CO). [$1\frac{1}{2}$]

16. Explain the following properties of ionic compounds:

(a) They have high melting and boiling points.

(b) They conduct electricity in the molten state but not in the solid state.

(c) They dissolve in water but not in kerosene or petrol.

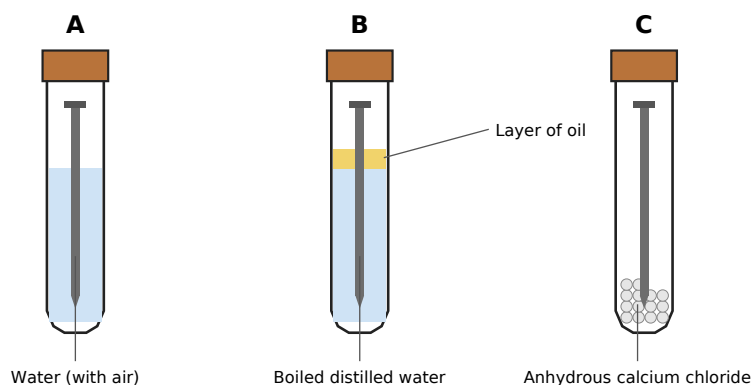
Solution:

(a) The oppositely charged ions are held by **strong electrostatic (inter-ionic) forces**; a large amount of energy is needed to break them. e.g. NaCl melts at 1074 K. [1]

(b) Conduction needs movement of charged particles. In the solid, ions are held in a **rigid structure** and cannot move. On melting, heat overcomes the attractive forces and ions **move freely** to carry current. [1]

(c) Electrovalent compounds are generally **soluble in water** and **insoluble in solvents such as kerosene and petrol**; in water the ions separate and move about. [1]

17. A student set up three test tubes, each containing a clean iron nail, as shown below, and left them for a few days.



- (a) In which test tube(s) will the iron nail rust? Give a reason.
 (b) Why was the water in test tube B boiled, and why was a layer of oil added?
 (c) What is the role of anhydrous calcium chloride in test tube C? What do you conclude about the conditions needed for rusting?

Solution:

- (a) Only in **test tube A**, because there the nail is exposed to **both air and water**. [1]
 (b) Boiling **removes dissolved air** from the water; the oil layer floats on top and **prevents air from dissolving again**. So the nail is in contact with water only. [1]
 (c) Anhydrous CaCl_2 **absorbs moisture**, so the air in C is dry. [$\frac{1}{2}$] Conclusion: iron rusts only when **both air (oxygen) and water (moisture)** are present. [$\frac{1}{2}$]

SECTION - D

Question 18 carries 5 marks.

18. (a) Why can sodium, magnesium and aluminium not be obtained by heating their oxides with carbon? How is sodium obtained? Write the reactions at the cathode and the anode.
 (b) Write the balanced equation for the thermite reaction. Why is the iron produced in the molten state? Give one use of this reaction.
 (c) In the reaction $3\text{MnO}_2(\text{s}) + 4\text{Al}(\text{s}) \rightarrow 3\text{Mn}(\text{l}) + 2\text{Al}_2\text{O}_3(\text{s}) + \text{Heat}$, identify the substance oxidised and the substance reduced.

Solution:

- (a) These metals are high in the reactivity series and have **more affinity for oxygen than carbon**, so carbon cannot reduce their oxides. [$\frac{1}{2}$]

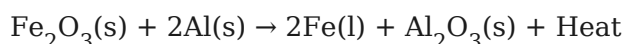
Sodium is obtained by **electrolytic reduction** (electrolysis) of **molten sodium chloride**.

Sodium deposits at the cathode, chlorine is liberated at the anode. [$\frac{1}{2}$]



[1 mark for both reactions; (a) total 2 marks]

(b)



Check: Fe 2 = 2, O 3 = 3, Al 2 = 2. [1]

The reaction is **highly exothermic**; the heat released is so large that iron is formed in the molten state. Use: **joining railway tracks** or cracked machine parts. [$\frac{1}{2} + \frac{1}{2}$]

- (c) Al gains oxygen ($\text{Al} \rightarrow \text{Al}_2\text{O}_3$): **aluminium is oxidised**. MnO_2 loses oxygen ($\text{MnO}_2 \rightarrow \text{Mn}$): **MnO_2 is reduced**. [$\frac{1}{2} + \frac{1}{2}$]

SECTION - E (Case Study Based Questions)

Questions 19 and 20 carry 4 marks each.

19. Samples of four metals W, X, Y and Z were added one by one to the solutions listed below. The observations are tabulated:

Metal	Iron(II) sulphate	Copper(II) sulphate	Zinc sulphate	Silver nitrate
W	Displacement	Displacement	Displacement	Displacement
X	No reaction	Displacement	No reaction	Displacement
Y	No reaction	No reaction	No reaction	Displacement
Z	No reaction	No reaction	No reaction	No reaction

- (a) Which is the most reactive and which is the least reactive of these metals? **(1)**
(b) Arrange W, X, Y and Z in decreasing order of reactivity. **(1)**
(c) Y is a reddish-brown metal used in electrical wiring. What would you observe when Y is placed in silver nitrate solution? Write the balanced equation. **(2)**

OR

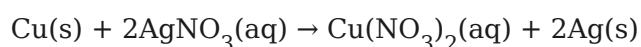
- (c) Which of the four solutions can be safely stored in a container made of metal X? Give reasons. **(2)**

Solution:

(a) Most reactive: **W** - it displaces all four metals, including zinc. Least reactive: **Z** - it displaces none, not even silver. [$\frac{1}{2} + \frac{1}{2}$]

(b) W displaces 4 metals, X displaces 2 (Cu, Ag), Y displaces 1 (Ag), Z displaces none.
Decreasing reactivity: **W > X > Y > Z**. [1]

(c) Y is **copper**. It displaces silver: a **shiny greyish-white deposit of silver** forms on the copper, and the colourless solution slowly turns **blue** (copper nitrate). [1]



[1 mark]

OR

(c) A solution can be stored in a container of X only if X does **not** react with it.

Safe: **iron(II) sulphate** and **zinc sulphate** - X shows no reaction with them (X is less reactive than Fe and Zn). [1]

Not safe: copper(II) sulphate and silver nitrate - X displaces Cu and Ag, so the container would be eaten away. [1]

20. Read the passage and answer the questions that follow.

A student burnt two elements separately. Element **A**, a silvery-white ribbon, burnt with a dazzling white flame, and its ash dissolved in water to give a solution that turned red litmus blue. Element **B**, a yellow powder, burnt with a blue flame giving pungent fumes; when these fumes were dissolved in water, the solution turned blue litmus red.

(a) Identify elements A and B. **(1)**

(b) What is the nature of the oxides of A and B? What general rule does this illustrate? **(1)**

(c) Write balanced equations for (i) the burning of A and the reaction of its oxide with water, and (ii) the burning of B and the reaction of its oxide with water. **(2)**

OR

(c) Element A does not react with cold water but reacts with hot water. Write the balanced equation and explain why A starts floating on the water. **(2)**

Solution:

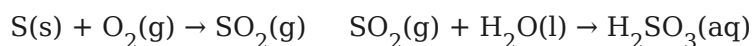
(a) A = **magnesium (Mg)**; B = **sulphur (S)**. [$\frac{1}{2} + \frac{1}{2}$]

(b) Oxide of A (MgO) is **basic**; oxide of B (SO₂) is **acidic**. Rule: **metals generally form basic oxides; non-metals form acidic oxides**. [1]

(c) (i)



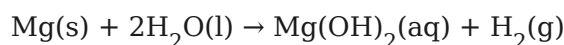
(ii)



[1 mark each]

OR

(c) Magnesium reacts with hot water to form magnesium hydroxide and hydrogen:



[1 mark]

It floats because **bubbles of hydrogen gas stick to its surface**. [1]

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