UNIQUE STUDY POINT

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Class: X	**Subject:** Science	**Session:** 2025-26
Chapter: 03 - Metals and Non-metals	**Time:** 1½ Hours	**Max. Marks:** 40

General Instructions:

1. All questions are compulsory.
2. This question paper contains 20 questions divided into five sections A, B, C, D and E.
3. Section A contains 10 MCQs of 1 mark each.
4. Section B contains 4 questions of 2 marks each.
5. Section C contains 3 questions of 3 marks each.
6. Section D contains 1 question of 5 marks.
7. Section E contains 2 Case Study Based questions of 4 marks each.

SECTION A - Multiple Choice Questions (1 mark each)

1. Which of the following metals can be cut with a knife?
(a) Iron
(b) Sodium
(c) Copper
(d) Aluminium

2. The ability of metals to be drawn into thin wires is called:
(a) Malleability
(b) Ductility
(c) Sonority
(d) Conductivity

3. Which metal is liquid at room temperature?
(a) Sodium
(b) Mercury
(c) Gallium
(d) Magnesium

4. Which of the following is the best conductor of heat?
(a) Iron
(b) Silver
(c) Lead
(d) Mercury

5. What type of oxide is formed when magnesium burns in air?
(a) Acidic oxide
(b) Basic oxide
(c) Neutral oxide
(d) Amphoteric oxide

6. Which gas is evolved when a metal reacts with dilute acid?

(a) Oxygen

(b) Hydrogen

(c) Carbon dioxide

(d) Nitrogen

7. Anodising is a process associated with:

(a) Iron

(b) Copper

(c) Aluminium

(d) Zinc

8. Which of the following is an amphoteric oxide?

(a) CaO

(b) MgO

(c) Al_2O_3

(d) Na_2O

9. The process of coating iron with zinc is called:

(a) Galvanisation

(b) Anodising

(c) Rusting

(d) Corrosion

10. Which metal is extracted by electrolytic reduction?

(a) Copper

(b) Iron

(c) Sodium

(d) Mercury

SECTION B - Short Answer Questions (2 marks each)

11. Explain the terms malleability and ductility with suitable examples.

12. Why are sodium and potassium stored under kerosene oil?

13. Write the chemical equation for the reaction of iron with steam.

14. What is meant by corrosion? Give one example.

SECTION C - Short Answer Questions (3 marks each)

15. Differentiate between the properties of metals and non-metals based on their physical characteristics.

16. Explain why aluminium oxide is called an amphoteric oxide. Support your answer with chemical equations.

17. Describe the Activity Series of metals and explain its significance in predicting chemical reactions.

SECTION D - Long Answer Question (5 marks)

18. Explain the process of extraction of metals from their ores. Describe how metals of medium reactivity like zinc are extracted from zinc carbonate ore.

SECTION E - Case Study Based Questions (4 marks each)

19. Case Study 1:

Ramesh conducted an experiment where he took samples of iron, copper, aluminium, and magnesium. He cleaned their surfaces with sandpaper and observed their appearance. Then he tried to cut these metals with a sharp knife. He also heated aluminium wire with a burner and fixed a pin at its free end using wax.

Based on this case study, answer the following questions:

(a) What property of metals is demonstrated when their surfaces shine after cleaning? (1 mark)

(b) Which metal could Ramesh cut easily with a knife and why? (1 mark)

(c) What would happen to the pin when the aluminium wire is heated? Explain. (2 marks)

20. Case Study 2:

A student performed displacement reactions by placing iron nails in copper sulphate solution and copper wire in iron sulphate solution. After 20 minutes, he observed that the iron nail developed a brown coating while the copper wire showed no visible change.

Based on this observation, answer the following:

(a) Write the balanced chemical equation for the reaction that occurred. (1 mark)

(b) Which metal is more reactive, iron or copper? Justify your answer. (1 mark)

(c) Name the type of reaction and state the principle behind it. (2 marks)

DETAILED ANSWER KEY - PAPER 01

SECTION A - Answers to MCQs

1. (b) Sodium

Sodium is an alkali metal that is very soft and can be easily cut with a knife.

2. (b) Ductility

Ductility is the property of metals to be drawn into thin wires. Gold is the most ductile metal.

3. (b) Mercury

Mercury is the only metal that remains liquid at room temperature.

4. (b) Silver

Silver is the best conductor of heat among all metals, followed by copper.

5. (b) Basic oxide

When magnesium burns in air, it forms magnesium oxide (MgO), which is a basic oxide.

6. (b) Hydrogen

When metals react with dilute acids, hydrogen gas is evolved along with salt formation.

7. (c) Aluminium

Anodising is a process of forming a thick protective oxide layer on aluminium.

8. (c) Al_2O_3

Aluminium oxide can react with both acids and bases, making it amphoteric.

9. (a) Galvanisation

Galvanisation is the process of coating iron or steel with a thin layer of zinc to prevent rusting.

10. (c) Sodium

Highly reactive metals like sodium are extracted by electrolytic reduction of their molten chlorides.

SECTION B - Answers to Short Answer Questions

11.

Malleability: It is the property of metals to be beaten into thin sheets. Example: Gold and silver are highly malleable and can be beaten into very thin sheets.

Ductility: It is the property of metals to be drawn into thin wires. Example: Copper is highly ductile and is used for making electrical wires. About 2 km of wire can be drawn from 1 gram of gold.

12.

Sodium and potassium are highly reactive metals that react vigorously with oxygen and moisture present in air. They catch fire if kept in open. To protect them and prevent accidental fires, they are stored immersed in kerosene oil which prevents their contact with air and moisture.

13.

The chemical equation for the reaction of iron with steam is:

$3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$

Iron reacts with steam to form iron(II,III) oxide (magnetic oxide of iron) and hydrogen gas.

14.

Corrosion: Corrosion is the process in which metals are slowly eaten away by the action of air, moisture, or chemicals on their surface.

Example: Rusting of iron - When iron is exposed to moist air for a long time, it acquires a brown flaky coating called rust. This is due to the formation of hydrated iron(III) oxide.

SECTION C - Answers to Short Answer Questions

15.

Differences between Metals and Non-metals:

Metals:

1. Lustrous (shiny appearance)
2. Malleable and ductile
3. Good conductors of heat and electricity
4. Generally solid at room temperature (except mercury)
5. Sonorous (produce sound when struck)

Non-metals:

1. Non-lustrous (except iodine and graphite)
2. Brittle (break easily when hammered)
3. Poor conductors of heat and electricity (except graphite)
4. May be solid, liquid, or gas at room temperature
5. Non-sonorous (do not produce sound)

16.

Aluminium oxide (Al_2O_3) is called an amphoteric oxide because it can react with both acids and bases to form salt and water, showing both acidic and basic properties.

Chemical equations:
Reaction with acid:
$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$

Reaction with base:
$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$
(Sodium aluminate is formed)

This dual nature makes Al_2O_3 an amphoteric oxide. Zinc oxide (ZnO) is another example of an amphoteric oxide.

17.

Activity Series: The Activity Series is a list of metals arranged in order of their decreasing reactivity. It helps predict the behavior of metals in chemical reactions.

Order (from most reactive to least reactive):
K > Na > Ca > Mg > Al > Zn > Fe > Pb > H > Cu > Hg > Ag > Au

Significance:
1. Metals above hydrogen can displace hydrogen from dilute acids
2. A more reactive metal can displace a less reactive metal from its salt solution

3. Helps predict which metals will react with water, steam, or acids
4. Determines the method of extraction of metals from their ores
5. Highly reactive metals require electrolytic reduction while less reactive metals can be reduced using carbon

SECTION D - Answer to Long Answer Question

18.

Extraction of Metals from Ores:

The process of extracting metals from their ores involves several steps:

1. Enrichment of Ore: The ore is concentrated by removing impurities like sand, soil (gangue) using various physical or chemical methods.

2. Conversion to Oxide: For metals of medium reactivity, the ore (usually carbonate or sulphide) is converted to oxide:
- **Calcination:** Carbonate ores are heated in limited air
- **Roasting:** Sulphide ores are heated in excess air

3. Reduction: The metal oxide is reduced to metal using a suitable reducing agent.

4. Refining: The crude metal is purified by electrolytic refining or other methods.

Extraction of Zinc from Zinc Carbonate ($ZnCO_3$):

Step 1 - Calcination:
$ZnCO_3(s) \rightarrow ZnO(s) + CO_2(g)$
(Zinc carbonate is converted to zinc oxide by heating in limited air)

Step 2 - Reduction:
$ZnO(s) + C(s) \rightarrow Zn(s) + CO(g)$
(Zinc oxide is reduced to metallic zinc using carbon as reducing agent)

The zinc obtained is then refined using electrolytic refining to get pure zinc metal.

SECTION E - Answers to Case Study Based Questions

19.

(a) The property demonstrated is **metallic lustre**. Metals have a shining surface in their pure state. When cleaned with sandpaper, the oxide layer is removed and the shiny metallic surface is visible.

(b) Ramesh could cut **magnesium** relatively easily compared to iron, copper, and aluminium. However, among common metals, sodium and potassium are the softest and can be cut easily with a knife. Magnesium is moderately soft among the metals listed in the experiment.

(c) When the aluminium wire is heated, the heat will be conducted through the wire (as metals are good conductors of heat). The wax holding the pin will melt due to the heat conducted through the wire, and the pin will fall down. This demonstrates that aluminium is a good conductor of heat. The wax melts before the aluminium wire itself melts because metals have high melting points.

20.

(a) The balanced chemical equation is:
$Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$
(Iron displaces copper from copper sulphate solution, forming iron sulphate and copper metal)

(b) Iron is more reactive than copper. This is justified because iron could displace copper from its salt solution (copper sulphate), while copper could not displace iron from iron sulphate solution. A more reactive metal can displace a less reactive metal from its compound.

(c) This is a **displacement reaction** (also called single displacement or substitution reaction).

Principle: A more reactive metal can displace a less reactive metal from its salt solution. According to the activity series, iron is placed above copper, making it more reactive. Therefore, iron can displace copper from its salt solution, but copper cannot displace iron. The brown coating on the iron nail is copper metal that has been displaced from the solution.
