CBSE CLASS X

Science (086)

ANSWER KEY

From previous CBSE Board Exam questions

Code: XJEXJE	Questions: 80	Maximum Marks: 158	Generated: 2026-06-15 13:05

SELECTIONS USED

Source	Previous-year board
Subject	Science
Lessons	Metals and Non-metals
Year	2022-2026
Questions selected	80

Composition — Types: 35 MCQ · 23 Short · 9 source_based · 8 Assertion–reason · 5 Very short · 4 Long

Q1. § 1.1 CHEMICAL EQUATIONS **[1]**

A metal ribbon 'X' burns in oxygen with a dazzling white flame forming a white ash 'Y'. The correct description of X, Y and the type of reaction is :

(a) X = Ca ; Y = CaO ; Type of reaction = Decomposition
(b) X = Mg ; Y = MgO ; Type of reaction = Combination
(c) X = Al ; Y = Al_2O_3 ; Type of reaction = Thermal decomposition
(d) X = Zn ; Y = ZnO ; Type of reaction = Endothermic

Previously asked in: 2023 31/4/1 Q3

◆ Chemical Reactions and Equations | Burning of Magnesium Ribbon – Observations and Characteristics | Reaction of Magnesium with Oxygen – Combustion and Product Identification | Types of chemical reactions – combination and oxidation

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Model Answer

(b) X = Mg ; Y = MgO ; Type of reaction = Combination

Magnesium ribbon burns in oxygen with a dazzling white flame to form white ash magnesium oxide: $2Mg + O_2 \rightarrow 2MgO$. This is a combination reaction.

Explanation

The key identifiers are: **metal ribbon** (Mg is described as a ribbon), **dazzling white flame**, and **white ash** (MgO) — all matching the textbook description in Activity 1.1 and Section 3.2.1. The reaction is a **combination** (two substances combine to form one product), not decomposition or thermal decomposition. Option (d) is wrong because this reaction is exothermic, not endothermic.

Q2. § 1.1.2 Balanced Chemical Equations **[1]**

Assertion (A) : In the following reaction
ZnO + C → Zn + CO
ZnO undergoes reduction.
Reason (R) : Carbon is a reducing agent that reduces ZnO to Zn.

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

Previously asked in: 2023 31/5/1 Q17

◆ **Chemical Reactions and Equations** | Oxidation and Reduction – Identifying Reducing Agent in a Redox Reaction | Oxidation and reduction (redox reactions) | Reduction of Metal Oxides with Carbon (Coke)

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Model Answer

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

In ZnO + C → Zn + CO, carbon removes oxygen from ZnO (reducing it to Zn), so ZnO is reduced and C acts as the reducing agent.

Explanation

ZnO loses oxygen → it undergoes **reduction**. Carbon gains oxygen → it is oxidised, acting as a **reducing agent**. Both statements are correct and R directly explains why A is true, making option (a) the right choice. Examiners expect students to identify the role of each substance in terms of gain/loss of oxygen.

Q3. § 2.1 UNDERSTANDING THE CHEMICAL PROPERTIES OF ACIDS AND BASES § 2.2 WHAT DO ALL ACIDS AND ALL BASES HAVE IN COMMON? **[1]**

In the experimental setup given below, it is observed that on passing the gas produced in the reaction in the solution 'X' the solution 'X' first turns milky and then colourless. The option that justifies the above stated observation is that 'X' is aqueous calcium hydroxide and

(a) it turns milky due to carbon dioxide gas liberated in the reaction and after sometime it becomes colourless due to formation of calcium carbonate.
(b) it turns milky due to formation of calcium carbonate and on passing excess of carbon dioxide it becomes colourless due to formation of calcium hydrogen carbonate which is soluble in water.
(c) it turns milky due to passing of carbon dioxide through it. It turns colourless as on further passing carbon dioxide, sodium hydrogen carbonate is formed which is soluble in water.
(d) the carbon dioxide liberated during the reaction turns lime water milky due to formation of calcium hydrogen carbonate and after some time it turns colourless due to formation of calcium carbonate which is soluble in water.

Previously asked in: 2023 31/1/1 Q1

◆ **Acids, Bases and Salts** | CO_2 gas turning lime water milky then colourless (excess CO_2 forming soluble calcium bicarbonate) | Reaction of $Ca(OH)_2$ solution with CO_2 – lime water test | Reaction of acids with carbonates

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Model Answer

(b) It turns milky due to formation of calcium carbonate and on passing excess of carbon dioxide it becomes colourless due to formation of calcium hydrogen carbonate which is soluble in water.

Explanation

The reactions are: $Ca(OH)_2 + CO_2 \rightarrow CaCO_3\downarrow$ (white/milky) + H_2O; then $CaCO_3 + H_2O + CO_2 \rightarrow Ca(HCO_3)_2$ (soluble, so colourless). Option (b) correctly identifies $CaCO_3$ as the cause of milkiness and soluble $Ca(HCO_3)_2$ as the reason for turning colourless. Options (c) and (d) wrongly mention sodium hydrogen carbonate or reverse the products.

Q4. § 3.1 PHYSICAL PROPERTIES **[1]**

Among the following, the metal with lowest density is :

(a) Lithium
(b) Lead
(c) Magnesium
(d) Aluminium

Previously asked in: 2023 31/2/1 Q5

◆ Metals and Non-metals | Physical properties of metals – density

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Model Answer

(a) Lithium

Alkali metals like lithium have low densities. Among the given options, lithium has the lowest density (~0.53 g/cm³).

Source: Physical Properties, Chapter 3, Section 3.1.1

Explanation

The textbook states that alkali metals (lithium, sodium, potassium) have **low densities**. Among the options — Lead (very dense), Magnesium and Aluminium (moderate density) — lithium is the lightest metal overall. Examiners expect you to recall this directly from the exceptions listed in Section 3.1.1.

Q5. § Chapter Introduction | § 3.3 HOW DO METALS AND NON-METALS REACT? **[1]**

Reaction between two elements A and B, forms a compound C. A loses electrons and B gains electrons. Which one of the following properties will not be shown by compound C ?

(A) It has high melting point.
(B) It is highly soluble in water.
(C) It has weak electrostatic forces of attraction between its oppositely charged ions.
(D) It conducts electricity in its molten state or aqueous solution.

Previously asked in: 2025 31/1/1 Q5

◆ Metals and Non-metals | Properties of Ionic Compounds

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Model Answer

(C) It has weak electrostatic forces of attraction between its oppositely charged ions.

Compound C is ionic (A loses electrons, B gains electrons). Ionic compounds have **strong** electrostatic forces, not weak ones.

Explanation

When A loses electrons and B gains electrons, an ionic compound (C) is formed. Ionic compounds have high melting points (A is correct), are highly soluble in water (B is correct), and conduct electricity in molten state or aqueous solution (D is correct). The defining feature of ionic compounds is **strong** electrostatic forces of attraction — so option (C) is the incorrect property, making it the right answer.

Q6. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.4 OCCURRENCE OF METALS § 3.5 CORROSION **[1]**

During electrolytic refining of copper, the anode, the cathode and the electrolyte used respectively are

A Impure copper, pure copper, acidified copper sulphate solution
B Pure copper, impure copper, sulphuric acid
C Pure copper, impure copper, acidified copper sulphate solution
D Impure copper, pure copper, distilled water

Previously asked in: 2025 31/5/1 Q6

◆ Metals and Non-metals | Electrolytic Refining of Metals

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Model Answer

Option A — Impure copper (anode), pure copper (cathode), acidified copper sulphate solution (electrolyte).

Source: Metals and Non-metals, Section 3.4.6 Refining of Metals

Explanation

The textbook clearly states: "the impure metal is made the anode and a thin strip of pure metal is made the cathode. A solution of the metal salt is used as an electrolyte." For copper, the electrolyte is acidified copper sulphate solution. Options B and C wrongly swap anode/cathode; Option D uses distilled water, which does not conduct electricity.

Q7. § 3.1 PHYSICAL PROPERTIES § 3.5 CORROSION **[1]**

Answer the following: Name the method used for refining silver.

Previously asked in: 2025 31/2/1 Q21 (b)

◆ Metals and Non-metals | Electrolytic Refining of Metals

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Model Answer

Silver is refined by **electrolytic refining**. In this method, impure silver is made the anode, pure silver is the cathode, and silver nitrate solution acts as the electrolyte.

Explanation

The examiner expects you to name the method (electrolytic refining) and may award the mark for the name alone, but briefly stating the anode/cathode/electrolyte shows understanding and secures the mark confidently. This applies to refining of any metal, including silver.

Q8. § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS § 3.4 OCCURRENCE OF METALS **[4]**

> The metals produced by various reduction processes are not very pure. They contain impurities, which must be removed to obtain pure metals. The most widely used method for refining impure metals is electrolytic refining.

Read the source given and answer the questions that follow :

(i) What is the cathode and anode made of in the refining of copper by this process ? [1]

(ii) Name the solution used in the above process and write its formula. [1]

(iii) How copper gets refined when electric current is passed in the electrolytic cell ? [2]

Previously asked in: 2024 31/1/1 Q37

◆ **Metals and Non-metals** Electrolytic Refining of Metals

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Model Answer

(i) In the electrolytic refining of copper:

- **Anode** — impure copper
- **Cathode** — pure (thin strip of) copper

(ii) The solution used is **acidified copper sulphate solution**.
Formula: **$CuSO_4$**

(iii) When electric current is passed:

- The impure copper anode slowly **dissolves** into the solution, releasing Cu^{2+} ions.
- These Cu^{2+} ions migrate to the cathode and **deposit** as pure copper.
- The insoluble impurities (such as gold, silver) from the anode settle at the bottom as **anode mud**.
- Thus, pure copper gets collected at the cathode.

Source: Chapter 3 – Metals and Non-metals, Electrolytic Refining

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Explanation

- (i) is a direct recall fact — anode = impure metal, cathode = pure metal. Don't reverse them.
- (ii) Examiners expect both the name AND formula; writing only one loses the mark.
- (iii) For 2 marks, cover **two key steps**: anode dissolving + cathode deposition. Mentioning anode mud is a bonus point that shows thorough knowledge.

Q9. § 3.1 PHYSICAL PROPERTIES **[1]**

The property by virtue of which a solid material can be drawn into thin wires is called :

(a) malleability
(b) ductility
(c) rigidity
(d) resistivity

Previously asked in: 2025 31/4/1 Q3

◆ **Metals and Non-metals** Ductility of Metals

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Model Answer

(b) ductility

The ability of metals to be drawn into thin wires is called ductility.

Source: Chapter 3, Section 3.1.1

Explanation

The question tests knowledge of physical properties of metals. "Malleability" refers to being beaten into thin sheets, not wires. "Ductility" is specifically defined in the textbook as the property of being drawn into thin wires. Examiners expect the exact term as stated in the NCERT text.

Q10. § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS **[3]**

Design an activity to show that metals are good conductors of heat and have high melting points.

Previously asked in: 2025 31/4/1 Q28

◆ **Metals and Non-metals** Physical properties of metals – thermal conductivity and high melting points

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Model Answer

Activity (Activity 3.5):

Materials required: Aluminium or copper wire, a stand, wax, a pin, spirit lamp/candle.

Procedure:

1. Clamp an aluminium or copper wire on a stand.
2. Fix a pin to the free end of the wire using wax.
3. Heat the wire with a spirit lamp near the clamped end.

Observation: After some time, the wax melts and the pin falls. However, the metal wire does **not** melt.

Conclusion: Heat travels from the heated end to the free end, showing metals are **good conductors of heat**. The wire remaining intact (not melting) shows metals have **high melting points**.

Source: Chapter 3, Activity 3.5, Section 3.1.1

Explanation

- Examiners expect: materials, procedure (steps), observation, and conclusion — all four components, even in 3 marks.
- The key two conclusions must both appear: (i) good conductor of heat, (ii) high melting point.
- The pin/wax trick is the standard NCERT method — describe it exactly.
- Don't write extra theory; keep it crisp and activity-focused.

Q11. § 3.2 CHEMICAL PROPERTIES OF METALS **[1]**

The products formed when Aluminium and Magnesium are burnt in the presence of air respectively are :

(A) Al_3O_4 and MgO_2
(B) Al_2O_3 and MgO
(C) Al_3O_4 and MgO
(D) Al_2O_3 and MgO_2

Previously asked in: 2025 31/1/1 Q2

◆ **Metals and Non-metals** Reactions of Metals with Oxygen (Burning in Air)

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Model Answer

(B) Al_2O_3 and MgO

When aluminium burns in air: $4Al + 3O_2 \rightarrow 2Al_2O_3$; when magnesium burns in air: $2Mg + O_2 \rightarrow 2MgO$.

Source: Chapter 3, Section 3.2.1

Explanation

The correct formulae come from the valencies: Al has valency 3 and O has valency 2, giving Al_2O_3; Mg has valency 2 and O has valency 2, giving MgO. Options with Al_3O_4 or MgO_2 are chemically incorrect. The textbook explicitly states the reaction $4Al + 3O_2 \rightarrow 2Al_{\text{}}O_3$ and magnesium oxide (MgO) is standard knowledge from the activity series chapter.

Q12. § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS § 3.4 OCCURRENCE OF METALS **[3]**

Draw a labelled diagram to show electrolytic refining of copper. State what happens when electric current is passed through the electrolyte taken in this case.

Previously asked in: 2024 31/2/1 Q28

◆ Metals and Non-metals | Electrolytic Refining of Metals (Copper)

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Model Answer

Labelled Diagram — Electrolytic Refining of Copper:

```
Battery
+ –
| |
Anode Cathode
(Impure (Pure
Copper) Copper)
| |
_____________________
| |
| CuSO4 solution |
|_____________________|
(Electrolyte)
```

(Diagram should show: battery connected to two copper electrodes dipped in copper sulphate ($CuSO_4$) solution, with anode labelled "impure copper" and cathode labelled "pure copper".)

What happens when electric current is passed:

When electric current is passed, the impure copper anode slowly dissolves into the $CuSO_4$ solution. Cu^{2+} ions from the solution get deposited as pure copper on the cathode. Insoluble impurities (like silver, gold) collect below the anode as **anode mud**.

Explanation

- **1 mark** for the correctly labelled diagram (anode = impure Cu, cathode = pure Cu, electrolyte = $CuSO_4$ solution, battery shown).
- **1 mark** for stating anode dissolves / copper ions migrate to cathode.
- **1 mark** for mentioning pure copper deposits at cathode AND impurities settle as anode mud.
- Examiners expect the term "anode mud" to be written explicitly — it fetches a mark.
- The diagram need not be elaborate; clear labels are what matter.

Q13. § 3.2 CHEMICAL PROPERTIES OF METALS | § 3.3 HOW DO METALS AND NON-METALS REACT? | § 3.4 OCCURRENCE OF METALS

State reasons for the following : Sodium metal is stored in bottle filled with kerosene oil.

Previously asked in: 2024 31/3/1 Q27 (b)

◆ **Metals and Non-metals** | Reactivity of Sodium with Air and Water – Storage of Sodium in Kerosene Oil

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Model Answer

Sodium is a highly reactive metal. It reacts vigorously with oxygen in air and also reacts violently with moisture/water, producing heat and hydrogen gas which can catch fire:

$$2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g) + heat$$

Kerosene oil does not react with sodium. It covers the metal completely, preventing contact with atmospheric oxygen and moisture. This protects sodium from accidental fires and unwanted reactions.

Source: Chapter 3, Section 3.2.1 and 3.2.2

Explanation

The examiner expects two key points: (1) sodium's high reactivity with both air (oxygen) and water, and (2) kerosene acts as an inert barrier preventing this contact. Writing the reaction with water earns full credit for a 2-mark question. Do not just say "it is reactive" — explain *what* it reacts with and *why* kerosene works (it is inert/does not react with sodium).

Q14. § 3.1 PHYSICAL PROPERTIES | § 3.2 CHEMICAL PROPERTIES OF METALS | § 3.3 HOW DO METALS AND NON-METALS REACT? **[3]**

Answer the following about ionic compounds.

(a) Show the formation of Aluminium Nitride (AlN) by the transfer of electrons. [At. no. of Al = 13; At. no. of N = 7]

(b) "Ionic compounds are solids and are generally brittle and break into pieces when pressure is applied." Give reason to justify the statement.

Previously asked in: 2025 31/5/1 Q28 (B)

◆ **Metals and Non-metals** | Formation of ionic compounds by electron transfer | Properties of ionic compounds – solid, brittle nature

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Model Answer

(a) Formation of Aluminium Nitride (AlN):

Electronic configuration:

- Al (At. no. 13): 2, 8, 3 → has 3 valence electrons
- N (At. no. 7): 2, 5 → needs 3 electrons to complete octet

Al loses 3 electrons to form Al^{3+}:

$$Al \rightarrow Al^{3+} + 3e^-$$

$$2, 8, 3 \qquad 2, 8$$

N gains 3 electrons to form N^{3-}:

$$N + 3e^- \rightarrow N^{3-}$$

$$2, 5 \qquad 2, 8$$

Al^{3+} and N^{3-} attract each other to form **AlN**.

(b) Reason for brittleness of ionic compounds:

Ionic compounds consist of a regular arrangement of oppositely charged ions held together by strong electrostatic forces. When pressure is applied, the layers of ions shift slightly. Ions of the same charge come opposite each other, causing strong repulsion between like charges. This repulsion breaks the crystal apart, making ionic compounds brittle.

Source: Chapter 3, Section 3.3.1

Explanation

- **(a)** Always show electronic configuration, electron loss/gain equations, and name the ions formed — examiners award marks for each step. [2 marks]
- **(b)** The key concept is the **shift of ionic layers** causing like-charge repulsion, not just "strong forces." Simply saying "strong forces make it hard" is incomplete — explain *why* it breaks. [1 mark]
- Do not confuse hardness (due to strong attraction) with brittleness (due to repulsion when layers shift).

Q15. § 3.3 HOW DO METALS AND NON-METALS REACT? **[1]**

The number of electrons in the outermost shell of the atom of a non-metal can be :

(a) 1, 2 or 3
(b) 3, 4 or 5
(c) 5, 6 or 7
(d) 5, 6 or 8

Previously asked in: 2023 31/2/1 Q6

◆ Metals and Non-metals | Electronic configuration of non-metals and valence electrons

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Model Answer

(c) 5, 6 or 7

Non-metals gain electrons to complete their octet. From Table 3.3, non-metals like Nitrogen (5), Oxygen (6), Fluorine/Chlorine (7) have 5, 6, or 7 electrons in their outermost shell.

Source: Chapter 3, Section 3.3

Explanation

- Non-metals need to **gain** electrons to attain a stable octet, so they already have close to 8 electrons in their valence shell (5, 6, or 7).
- Option (d) is a trap — 8 electrons in the outermost shell means the atom is already a noble gas (completely stable), not a non-metal.
- Option (a)/(b) describes metals or semi-metals (1–3 or 3 electrons → tendency to lose electrons).
- Always link the answer to examples from the table: N=5, O=6, F/Cl=7.

Q16. § 3.3 HOW DO METALS AND NON-METALS REACT? **[2]**

Show the formation of the following ionic compounds by transfer of electrons between the combining atoms :
(Given : Atomic number : Na = 11, Mg = 12, O = 8, Cl = 17)

(i) Sodium oxide (Na_2O) [1]

(ii) Magnesium chloride ($MgCl_2$) [1]

Previously asked in: 2026 31/3/1 Q25

◆ **Metals and Non-metals** | Electronic configuration and valency of Na, Mg, O, Cl | Formation of ionic compounds by electron transfer

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Model Answer

(i) Formation of Sodium Oxide (Na_2O):

Na has 2,8,1 configuration. Each Na atom loses 1 electron to form Na^+.
O has 2,6 configuration. O atom gains 2 electrons to form O^{2-}.

$$Na \rightarrow Na^+ + e^- \quad (\times 2)$$

$$2,8,1 \quad 2,8$$

$$O + 2e^- \rightarrow O^{2-}$$

$$2,6 \qquad 2,8$$

Two Na^+ and one O^{2-} combine to form **Na_2O**.

(ii) Formation of Magnesium Chloride ($MgCl_2$):

Mg has 2,8,2 configuration. Mg loses 2 electrons to form Mg^{2+}.
Cl has 2,8,7 configuration. Each Cl atom gains 1 electron to form Cl^-.

$$Mg \rightarrow Mg^{2+} + 2e^-$$

$$2,8,2 \qquad 2,8$$

$$Cl + e^- \rightarrow Cl^- \quad (\times 2)$$

$$2,8,7 \quad 2,8,8$$

One Mg^{2+} and two Cl^- combine to form **$MgCl_2$**.

Source: Chapter 3, Section 3.3

Explanation

- Always write the electronic configuration alongside each atom/ion to show the before-and-after electron arrangement — examiners specifically look for this.
- Show which atom **loses** electrons (metal → cation) and which **gains** (non-metal → anion).
- For Na_2O: two Na atoms are needed because O needs 2 electrons and each Na gives only 1. This is the key logic to state.
- Mention the final ionic formula to complete the answer.
- The (×2) notation neatly shows that the half-equation is repeated twice without rewriting it.

Q17. § 3.3 HOW DO METALS AND NON-METALS REACT? **[1]**

Assertion (A) : Hydrogen gas is not evolved when zinc reacts with nitric acid.
Reason (R) : Nitric acid oxidises the hydrogen gas produced to water and itself gets reduced.

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

Previously asked in: 2024 31/1/1 Q17

◆ **Metals and Non-metals** | Reaction of metals with nitric acid – no hydrogen gas evolution

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Model Answer

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

Nitric acid is a strong oxidising agent; it oxidises the H_2 produced to water and itself gets reduced, so no hydrogen gas is evolved.

Explanation

The key fact is that HNO_3 acts as an oxidising agent — it immediately oxidises any nascent hydrogen to water and is itself reduced (to oxides of nitrogen). This directly explains why H_2 is not evolved when Zn reacts with HNO_3, making R the correct and complete explanation of A. Choose option (a).

Q18. § 3.2 CHEMICAL PROPERTIES OF METALS **[4]**

> The melting points and boiling points of some ionic compounds are given below :
>
> Compound | Melting Point (K) | Boiling Point (K)
> NaCl | 1074 | 1686
> LiCl | 887 | 1600
> $CaCl_2$ | 1045 | 1900
> CaO | 2850 | 3120
> $MgCl_2$ | 981 | 1685
>
> These compounds are termed ionic because they are formed by the transfer of electrons from a metal to a non-metal. The electron transfer in such compounds is controlled by the electronic configuration of the elements involved. Every element tends to attain a completely filled valence shell of its nearest noble gas or a stable octet.

Read the following and answer the questions:

(i) Show the electron transfer in the formation of magnesium chloride. [1]

(ii) List two properties of ionic compounds other than their high melting and boiling points. [1]

(iii) Answer (A) or (B): [2]

Previously asked in: 2023 31/4/1 Q37

◆ **Metals and Non-metals** | Electron transfer in formation of ionic compounds ($MgCl_2$) | Ionic compounds – melting and boiling points | Properties of Ionic Compounds

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Model Answer

(i) Electron transfer in formation of $MgCl_2$:

Mg has 2 valence electrons; each Cl needs 1 electron.

$Mg \rightarrow Mg^{2+} + 2e^-$
$Cl + e^- \rightarrow Cl^-$ (×2)

So $Mg^{2+} + 2Cl^- \rightarrow MgCl_2$

(ii) Two properties of ionic compounds:

1. They are soluble in water (polar solvents).
2. They conduct electricity in molten state or in aqueous solution (due to free ions).

(iii) *(The sub-question (A)/(B) options are not printed in the passage provided. Please provide the actual text of option A or B to receive a complete answer.)*

Source: Chapter 3 – Metals and Non-metals, Chemical Bonding / Ionic Compounds section

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Explanation

- **(i)** Examiners expect you to show the dot-structure or ionic equation clearly indicating Mg loses $2e^-$ and each Cl gains $1e^-$. Even a simple equation with charges is accepted.
- **(ii)** Do NOT repeat high melting/boiling points — the question says "other than." Conductivity and solubility in water are the two standard NCERT properties to cite.

- **(iii)** Since the A/B options were not included in the extract given, the answer cannot be written. In your actual exam, you will see both options and must choose one — budget roughly 40–50 words for a 2-mark answer.

Q19. § 3.3 HOW DO METALS AND NON-METALS REACT? **[3]**

Write the electron-dot structures of (i) sodium, and (ii) oxygen. Using these structures, show the formation of sodium oxide. Mark the anion and cation present in this compound.
(At. No. – Sodium = 11 and Oxygen = 8)

Previously asked in: 2025 31/2/1 Q28

◆ **Metals and Non-metals** | Electron-dot (Lewis) structures of sodium and oxygen | Formation of ionic compound – sodium oxide (Na_2O)

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Model Answer

(i) Electron-dot structures:

- **Sodium** (At. No. 11; configuration 2, 8, 1): one dot around the symbol Na.

Na·

- **Oxygen** (At. No. 8; configuration 2, 6): six dots around the symbol O.

:Ö: (six electrons shown around O)

(ii) Formation of sodium oxide (Na_2O):

Oxygen needs 2 electrons to complete its octet. Each sodium atom donates 1 electron. So **2 sodium atoms** each transfer 1 electron to **one oxygen atom**:

$$Na \rightarrow Na^+ + e^-$$

$$Na \rightarrow Na^+ + e^-$$

$$O + 2e^- \rightarrow O^{2-}$$

The compound formed is **Na_2O**.

(iii) Ions present:

- **Na^+ → Cation** (sodium ion)
- **O^{2-} → Anion** (oxide ion)

Source: Chapter 3, Section 3.3 — How do Metals and Non-metals React?

Explanation

- Draw electron-dot (Lewis) structures by placing dots equal to valence electrons around the symbol: Na has 1 valence electron; O has 6.
- For Na_2O, show **two** Na atoms each losing one electron (since O needs 2 electrons to achieve octet).
- Examiners specifically expect you to **label the cation (Na^+) and anion (O^{2-})** — missing this costs marks.
- The transfer of electrons makes this an **ionic compound**; no need to explain bonding in detail for 3 marks.

Q20. § 3.3 HOW DO METALS AND NON-METALS REACT? **[1]**

Assertion (A) : Hydrogen gas is not evolved when a metal reacts with nitric acid.
Reason (R) : Nitric acid is a strong reducing agent and reduces the hydrogen produced in the reaction to water.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2025 31/3/1 Q17

◆ Metals and Non-metals | Reaction of metals with nitric acid – no hydrogen gas evolution

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Model Answer

(C) Assertion (A) is true, but Reason (R) is false.

Assertion is correct — hydrogen gas is not evolved when metals react with nitric acid. However, Reason is false because nitric acid is a strong **oxidising** agent (not reducing agent), which oxidises the hydrogen produced to water.

Explanation

The key error in the Reason is the wrong identification of nitric acid as a "reducing agent." Nitric acid is a strong **oxidising** agent — this is a common factual trap in Assertion-Reason questions. Examiners specifically test whether students can spot this reversal. Always remember: HNO_3 oxidises H_2 to H_2O, hence no hydrogen gas is released when metals react with it (except with very dilute HNO_3 and magnesium/manganese).

Q21. § 3.2 CHEMICAL PROPERTIES OF METALS | § 3.3 HOW DO METALS AND NON-METALS REACT? **[1]**

Which gas is evolved when magnesium metal reacts with very dilute HNO_3 ?

(A) Oxygen
(B) Nitrogen
(C) Hydrogen
(D) Nitrogen Dioxide

Previously asked in: 2026 31/5/1 Q23

◆ Metals and Non-metals | Reaction of metals with dilute nitric acid (evolution of H_2 gas) | Reaction of metals with nitric acid – no hydrogen gas evolution

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Model Answer

(C) Hydrogen

Magnesium (Mg) reacts with very dilute HNO_3 to evolve H_2 gas, unlike other metals where HNO_3 (a strong oxidising agent) oxidises H_2 to water.

Explanation

The textbook explicitly states: *"But magnesium (Mg) and manganese (Mn) react with very dilute HNO_3 to evolve H_2 gas."* This is an exception to the general rule that metals do not produce hydrogen with nitric acid. Examiners expect students to recall this specific exception.

Q22. § 3.3 HOW DO METALS AND NON-METALS REACT?

State reasons for the following : In the reactions of nitric acid with metals, generally hydrogen gas is not evolved.

Previously asked in: 2024 31/3/1 Q27 (c)

◆ **Metals and Non-metals** | Reaction of metals with nitric acid – no hydrogen gas evolution

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Model Answer

Nitric acid is a strong oxidising agent. When metals react with nitric acid, the hydrogen gas produced is immediately oxidised to water by the nitric acid itself. Instead of hydrogen, oxides of nitrogen (such as NO_2, NO) are evolved as by-products. Thus, hydrogen is generally not liberated in reactions of metals with nitric acid.

Source: Metals and Non-metals, Chapter 3

Explanation

- The key reason is the **oxidising nature of HNO_3** — examiners specifically look for this phrase.
- Mention that H_2 is oxidised to H_2O before it can escape, and that nitrogen oxides (NO_2 or NO) are released instead.
- This is a common 2-mark reason-based question; one clear explanation with the oxidising agent point scores full marks. Avoid writing a long paragraph — two to three crisp sentences are enough.

Q23. § 3.3 HOW DO METALS AND NON-METALS REACT? **[2]**

Show the formation of magnesium chloride by electron transfer. Write the name of the cation and anion present in the compound formed. (Atomic Number of Mg = 12, Cl = 17)

Previously asked in: 2025 31/4/1 Q22(A)

◆ Metals and Non-metals | Cations and Anions in Ionic Compounds | Formation of ionic compounds by electron transfer

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Model Answer

Mg has electronic configuration 2, 8, 2. It loses 2 electrons to form Mg^{2+}.
Cl has electronic configuration 2, 8, 7. Each Cl atom gains 1 electron to form Cl^{-}.

$$Mg \rightarrow Mg^{2+} + 2e^{-}$$

$$(2,8,2) \qquad (2,8)$$

$$Cl + e^{-} \rightarrow Cl^{-}$$

$$(2,8,7) \quad (2,8,8)$$

Since Mg releases 2 electrons and each Cl needs 1, two Cl atoms are required → **$MgCl_2$** is formed.

- **Cation:** Magnesium ion (Mg^{2+})
- **Anion:** Chloride ion (Cl^{-})

Source: Chapter 3, Section 3.3 – How do Metals and Non-metals React?

Explanation

- Examiners expect the electron transfer equations with electronic configurations written below each species — this is the standard format shown in the textbook (Fig. 3.6).
- Clearly state that **two** Cl atoms are needed because Mg loses **two** electrons.
- Name both the cation and anion explicitly — easy 1 mark if not missed.
- Avoid drawing dot-cross diagrams unless specifically asked; the transfer equations are sufficient here.

Q24. § 3.4 OCCURRENCE OF METALS **[3]**

Name the ore of mercury and state the form in which it is found in nature. Write the chemical equations along with the condition required for the reactions involved in the extraction of mercury from its ore.

Previously asked in: 2024 31/5/1 Q28

◆ **Metals and Non-metals** | Extraction of metals from sulphide ores – Mercury (Cinnabar/HgS)

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Model Answer

Ore of Mercury: Cinnabar (HgS). It is found in the **combined state** (as a sulphide compound) in nature.

Extraction of Mercury:

Step 1: Cinnabar is heated strongly in air, converting it to mercuric oxide:

$$2HgS(s) + 3O_2(g) \xrightarrow{Heat} 2HgO(s) + 2SO_2(g)$$

Step 2: Mercuric oxide is further heated, and being a low-activity metal, it decomposes to give mercury:

$$2HgO(s) \xrightarrow{Heat} 2Hg(l) + O_2(g)$$

No reducing agent is needed; heat alone is sufficient because mercury is low in the activity series.

Source: Chapter 3, Section 3.4.3

Explanation

- The question awards 1 mark for naming the ore and its form; 2 marks for the two balanced equations with conditions.
- Always write the condition (Heat) above the arrow and include state symbols — examiners check both.
- The key idea to state: since Hg is **low in the activity series**, simple heating suffices — no carbon reduction needed. Mentioning this shows conceptual understanding and can fetch full marks.

Q25. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.4 OCCURRENCE OF METALS **[4]**

> An electrochemical process is used for refining metals by selectively dissolving and depositing them through electrolysis. Electrolytic refining is used for metals like Copper, Zinc, Tin, Nickel, Silver and Gold.

Read the following passage and answer the questions that follow :

(a) Define anode mud. [1]

(b) In electrolytic refining of copper, name the anode and the cathode. [1]

(c) With the help of chemical equations, show the extraction of copper from its ore Cu_2S. [2]

Previously asked in: 2026 31/3/1 Q28

◆ **Metals and Non-metals** | Electrolytic Refining of Metals | Extraction of Copper from Cu_2S (Copper Glance)

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Model Answer

(a) During electrolytic refining, the impurities (like gold, silver, platinum) that settle below the anode at the bottom of the electrolytic solution are called **anode mud**.

(b)

- **Anode:** Impure copper (thick block)
- **Cathode:** Pure copper (thin strip)

(c) Extraction of copper from Cu_2S:

Step 1 – Roasting:

$$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$$

Step 2 – Reduction:

$$2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$$

Copper is obtained as a molten mass.

Source: Metals and Non-Metals, Electrolytic Refining & Extraction of Metals

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Explanation

- **Anode mud** is a standard definition question — mention that it settles *below the anode* and contains precious metal impurities.
- For **(b)**, examiners expect both "impure copper = anode" and "pure copper = cathode" clearly stated.
- For **(c)**, both steps (roasting + auto-reduction) with balanced equations are required for full 2 marks. Missing either equation costs a mark.

Q26. § 3.4 OCCURRENCE OF METALS **[4]**

> Most of metals occur in combined state in form of ores. Carbonate ores are converted into oxides by calcination and sulphide ores by roasting. Oxides are reduced with suitable reducing agent like carbon to get free metal. Highly reactive metals like – Al, Mg are also used as reducing agents to obtain metal from their oxides. Most reactive metals are obtained by electrolytic reduction of their molten ores. Alloying is a very good method of improving the properties of a metal. We can get desired properties by this method. The electrical conductivity and melting point of an alloy is less than that of pure metals.

Read the following passage and answer the questions given below :

(a) Why carbonate or sulphide ores are converted to oxides before extraction of metal from it ? [1]

(b) Write a reaction in which Aluminium is used as a reducing agent to obtain metal from its oxide. [1]

(c) How is copper obtained from its ore (Cu_2S) ? Give equations of the reactions. [2]

Previously asked in: 2026 31/1/1 Q28

♦ **Metals and Non-metals** Metallurgy: extraction of metals from ores (calcination, roasting, reduction)

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Model Answer

(a) Carbonate and sulphide ores are converted to oxides because oxides are easier to reduce using reducing agents like carbon to obtain the free metal.

(b) Thermite reaction — Aluminium reduces iron(III) oxide:

$$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$$

(c) Cu_2S (copper glance) is roasted in the presence of air (oxygen) to obtain copper directly:

Step 1 — Partial roasting:

$$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$$

Step 2 — Reduction of Cu_2O by remaining Cu_2S:

$$2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$$

Thus, copper metal is obtained.

Source: Metals and Non-metals, Extraction of Metals

Explanation

- **(a)** Key point: oxides are **easier to reduce** than carbonates/sulphides — one line is enough.
- **(b)** Any thermite-type reaction works; Fe_2O_3 + Al is the standard NCERT example. Write the balanced equation correctly.
- **(c)** This is a 2-mark question — examiners expect **both steps** with balanced equations. Cu_2S roasting is a special case where no external reducing agent is needed; the ore itself acts as the reducing agent in the second step. Award marks are split: 1 for each correct equation.

Q27. § 3.4 OCCURRENCE OF METALS **[1]**

The most common method of extraction of metals from their oxide ores is :

(A) Reduction with carbon
(B) Reduction with hydrogen
(C) Reduction with aluminium
(D) Electrolytic reduction

Previously asked in: 2025 31/3/1 Q3

◆ Metals and Non-metals | Extraction of Metals from Oxide Ores by Reduction

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Model Answer

(A) Reduction with carbon

The most common method of extracting metals from their oxide ores is reduction with carbon (coke). Metals in the middle of the activity series (Zn, Fe, Pb, Cu) are commonly extracted this way, e.g., $ZnO + C \rightarrow Zn + CO$.

Source: Metals and Non-metals, Section 3.4.4

Explanation

The textbook (Fig. 3.9 and Section 3.4.4) clearly states that Zn, Fe, Pb, Cu — the largest group of commercially important metals — are extracted by **reduction using carbon**. Electrolytic reduction is used only for highly reactive metals (K, Na, Ca, Mg, Al), which is a special case, not the "most common" method. Reduction with Al (thermite) and H_2 are used in specific/limited cases only. Carbon (coke) is cheap and widely used, making option (A) correct.

Q28. § 3.4 OCCURRENCE OF METALS **[1]**

The metals which are found in both free state as well as combined state are :

A Gold and platinum
B Platinum and silver
C Copper and silver
D Gold and silver

Previously asked in: 2024 31/4/1 Q4

◆ Metals and Non-metals | Occurrence of Metals – Free State and Combined State

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Model Answer

Answer: (C) Copper and silver

According to the textbook, gold, silver, platinum and copper are found in the free state, but **copper and silver** are also found in the combined state as sulphide or oxide ores.

Explanation

The key distinction here is "both free state **and** combined state." Gold and platinum occur only in free (native) state. Copper and silver occur in both — hence option C is correct. This is directly stated in section 3.4.1.

Q29. § 3.4 OCCURRENCE OF METALS **[1]**

Assertion (A) : The extraction of metals from their sulphide ores cannot take place without roasting of the ore.
Reason (R) : Roasting converts sulphide ores directly into metals.

A Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
B Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).
C Assertion (A) is true, but Reason (R) is false.
D Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2024 31/4/1 Q17

◆ Metals and Non-metals | Roasting of Sulphide Ores

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Model Answer

Answer: C

Assertion (A) is true — sulphide ores must be roasted (converted to oxides) before reduction to extract the metal. Reason (R) is false — roasting converts sulphide ores into **metal oxides**, not directly into metals.

Explanation

The key distinction: roasting ($2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$) produces a **metal oxide**, which is then reduced (e.g., by carbon) to get the metal. Examiners expect you to know the two-step process. The Reason wrongly claims roasting gives the metal directly — making R false while A remains correct.

Q30. § 3.1 PHYSICAL PROPERTIES § 3.4 OCCURRENCE OF METALS **[3]**

State giving reason the reduction process to obtain the following metals from their compounds : (i) Mercury, (ii) Copper and (iii) Sodium

Previously asked in: 2024 31/3/1 Q28(a)

◆ **Metals and Non-metals** Extraction of Copper by reduction with carbon/self-reduction Extraction of Mercury by thermal decomposition of HgS/HgO Extraction of Sodium by electrolytic reduction Extraction of metals by reduction (thermal decomposition, reduction with carbon, electrolytic reduction)

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Model Answer

(i) Mercury – Mercury is low in the activity series. HgS (cinnabar) is first roasted in air to form HgO, which on further heating is reduced to mercury by thermal decomposition (heating alone):

$$2HgO \xrightarrow{\Delta} 2Hg + O_2$$

(ii) Copper – Copper is also low in the activity series. Cu_2S is heated in air; the Cu_2O formed reacts with remaining Cu_2S to give copper by thermal reduction (heating alone):

$$2Cu_2O + Cu_2S \xrightarrow{\Delta} 6Cu + SO_2$$

(iii) Sodium – Sodium is at the top of the activity series and is highly reactive. Carbon cannot reduce its oxide. So sodium is obtained by **electrolytic reduction** of molten NaCl:

$$Na^+ + e^- \rightarrow Na \text{ (at cathode)}$$

Source: Chapter 3, Sections 3.4.3 and 3.4.5

Explanation

- The key to this question is **linking reactivity position to extraction method**: low reactivity → heating alone; high reactivity → electrolysis.
- Always state the **reason** (position in activity series) before the method — examiners look for it explicitly.
- Writing the chemical equation earns marks and shows precision; include it for each metal.
- Sodium cannot be reduced by carbon because it has greater affinity for oxygen than carbon does — this is the reason the examiner wants.

Q31. § 3.5 CORROSION **[3]**

Observe the following diagram showing an experiment to determine the conditions under which a metal 'M' corrodes. List your observations in each of the three cases A, B and C with reason, if the metal 'M' is generally protected against corrosion by the method of galvanisation.

Previously asked in: 2025 31/5/1 Q28 (A)

◆ Metals and Non-metals | Corrosion – conditions and prevention by galvanisation

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Model Answer

Tube A (Moist Air + Metal M): Metal M will corrode/rust. Both moisture and air (oxygen) are present, which are the two necessary conditions for corrosion.

Tube B (Moist Air + Oil + Metal M): Metal M will **not** corrode. The layer of oil prevents air (oxygen) from reaching the metal surface, so corrosion does not occur.

Tube C (Dry Air + Drying Agent + Metal M): Metal M will **not** corrode. The drying agent absorbs all moisture, so only dry air is present. Absence of moisture prevents corrosion.

Conclusion regarding galvanisation: Since metal M is protected by galvanisation, it is **iron/steel**. Galvanisation involves coating iron with a thin layer of zinc, which prevents contact with moisture and air, thus preventing corrosion even if the coating is slightly damaged.

Source: Chapter 3 – Metals and Non-metals, Section 3.5 Corrosion (Activity 3.14) and Section 3.5.1 Prevention of Corrosion

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Explanation

- The key concept is that **both moisture and oxygen are required simultaneously** for corrosion (rusting) to occur.
- In Tube B, oil blocks dissolved air; in Tube C, the drying agent removes moisture — either condition missing stops corrosion.
- The mention of galvanisation is a clue that metal M is **iron**, since galvanisation specifically protects iron/steel with a zinc coating.
- Examiners expect observations for **all three tubes** with reasons — never skip any. Award marks are split one per tube.

Q32. § 3.2 CHEMICAL PROPERTIES OF METALS | § 3.3 HOW DO METALS AND NON-METALS REACT? | § 3.5 CORROSION **[3]**

It is observed that Calcium on reaction with water floats on its surface. Explain why it happens. Also write a balanced chemical equation for the reaction that occurs. What happens when the aqueous solution of the product of this reaction reacts with Carbon dioxide gas ? Write a balanced chemical equation for the reaction.

Previously asked in: 2024 31/2/1 Q27

◆ **Metals and Non-metals** | Balanced chemical equation for reaction of Calcium with Water | Reaction of $Ca(OH)_2$ solution with CO_2 – lime water test | Reaction of Calcium with Water – floating due to heat and gas evolved

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Model Answer

Calcium floats on water because the hydrogen gas (H_2) produced during the reaction lifts it to the surface. Also, calcium is less dense than water. The heat evolved is not enough to ignite the gas, so it just bubbles and causes calcium to float.

Reaction of calcium with water:

$$Ca(s) + 2H_2O(l) \rightarrow Ca(OH)_2(aq) + H_2(g)$$

The product formed is calcium hydroxide $[Ca(OH)_2]$. When its aqueous solution reacts with carbon dioxide, calcium carbonate is formed:

$$Ca(OH)_2(aq) + CO_2(g) \rightarrow CaCO_3(s) + H_2O(l)$$

Source: Chapter 1, Chemical Reactions and Equations

Explanation

- **Floating reason:** Two points are expected — hydrogen gas evolution (buoyancy effect) and low density of calcium. Many students write only one; mention both for full marks.
- The **first equation** is not directly in the passage (Ca + H2O is standard Class 10 chemistry); the passage gives the CaO + H2O reaction, but the Ca(OH)2 + CO2 equation (1.14) is directly from the text — make sure to reproduce it exactly.
- Note the **state symbols**: $CaCO_3$ is a precipitate (s), which is important.
- This is a 3-mark question: one mark for the explanation of floating, one for each balanced equation.

Q33. § 3.4 OCCURRENCE OF METALS § 3.5 CORROSION **[5]**

Answer the following :

(i) With the help of balanced chemical equations state the process of extracting (I) mercury from its ore called cinnabar, and (II) copper from its sulphide ore. [3]

(ii) Silver and copper articles slowly lose their shiny surfaces when exposed to air. Name the compounds formed on (I) silver articles, and (II) copper articles in the form of coating. [2]

Previously asked in: 2025 31/3/1 Q34(b)

◆ **Metals and Non-metals** Corrosion of silver and copper – tarnishing and coating compounds Extraction of metals from sulphide ores (cinnabar and copper sulphide) with balanced equations

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Model Answer

(i) Extraction of metals:

(I) Mercury from cinnabar (HgS):
Cinnabar (HgS) is heated in air. The ore gets converted to mercuric oxide, which on further heating decomposes to give mercury.

$$HgS + O_2 \xrightarrow{\Delta} HgO + SO_2$$

$$2HgO \xrightarrow{\Delta} 2Hg + O_2$$

(II) Copper from copper sulphide (Cu_2S):
Copper sulphide ore is heated in air to obtain copper directly.

$$Cu_2S + O_2 \xrightarrow{\Delta} 2Cu + SO_2$$

(ii) Compounds formed as coating:

(I) Silver articles: A black coating of **silver sulphide (Ag_2S)** is formed when silver reacts with sulphur compounds present in air.

(II) Copper articles: A green coating of **basic copper carbonate / copper carbonate [$CuCO_3 \cdot Cu(OH)_2$]** is formed when copper reacts with CO_2 and moisture in air.

This process of metals being attacked by substances in their surroundings is called **corrosion**.

Source: Chapter 1, Chemical Reactions and Equations, Section on Corrosion

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Explanation

- For (i), the examiner expects **balanced equations** with state symbols or at least correct formulae. Two-step extraction of mercury is important. For copper, a single-step roasting equation is standard at this level.
- For (ii), the exact names of the compounds are the key scoring points: **Ag_2S** (silver sulphide) for silver, and **basic copper carbonate / $Cu(OH)_2 \cdot CuCO_3$** (green coating) for copper. Mentioning the term "corrosion" adds value. Avoid writing "rust" — rust is specifically for iron.

Q34. § 3.2 CHEMICAL PROPERTIES OF METALS **[3]**

State giving reason for the change in appearance observed when each of the following metal is exposed to atmospheric air for some time : (i) Silver, (ii) Copper and (iii) Iron

Previously asked in: 2024 31/3/1 Q28(b)

◆ **Metals and Non-metals** | Corrosion of metals in atmospheric air | Green patina formation on Copper | Rusting of Iron | Tarnishing of Silver

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Model Answer

(i) Silver turns black when exposed to air. This is because silver reacts with sulphur present in the air to form a black coating of silver sulphide (Ag_2S).

(ii) Copper loses its shiny brown surface and gains a green coating. This is because copper reacts with moist carbon dioxide in the air to form basic copper carbonate (green).

(iii) Iron develops a brown flaky coating called rust when exposed to moist air. Iron reacts with oxygen and moisture to form hydrated iron oxide (rust, $Fe_2O_3 \cdot xH_2O$).

Source: Chapter 3, Section 3.5 Corrosion; Chapter 1, Section 1.3.1

Explanation

- Each metal = 1 mark: change in appearance + reason (chemical cause).
- Key terms examiners expect: **silver sulphide** (black), **basic copper carbonate** (green), **rust/hydrated iron oxide** (brown flaky).
- Don't just say "reacts with air" — name the specific substance (sulphur, CO_2 + moisture, O_2 + moisture) and the product formed. That's where the mark lies.

Q35. § 3.2 CHEMICAL PROPERTIES OF METALS **[1]**

A metal is used in the thermite process. When heated with air, it gives an oxide which is amphoteric in nature. The metal and its oxide are respectively :

(A) Mn, MnO_2
(B) Al, Al_2O_3
(C) Fe, Fe_2O_3
(D) Mg, MgO

Previously asked in: 2024 31/5/1 Q5

◆ Metals and Non-metals | Amphoteric oxides of metals | Thermite process and aluminium

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Model Answer

(B) Al, Al_2O_3

Aluminium is used in the thermite process ($Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$). When heated in air, it forms Al_2O_3, which is amphoteric — reacting with both acids and bases.

Source: Chapter 3, Sections 3.2.1 and 3.4.4

Explanation

Two clues identify the metal: (1) use in the **thermite reaction** — the textbook explicitly states aluminium reduces Fe_2O_3 in the thermit reaction; (2) the oxide must be **amphoteric** — the textbook names Al_2O_3 and ZnO as the amphoteric oxides. Only option (B) satisfies both conditions. Fe_2O_3 is basic, not amphoteric, so (C) is wrong despite iron being involved in the thermite reaction.

Q36. § 3.2 CHEMICAL PROPERTIES OF METALS **[1]**

When Mg metal is treated with hot water, it starts floating on the surface of the water. The reason for its different behaviour is :

(A) Mg is a lighter element than water.
(B) Mg reacts with water to produce H_2 gas which helps in floating.
(C) Mg reacts with water to produce N_2 gas which helps in floating.
(D) Mg reacts with water to form CO_2 gas which helps in floating.

Previously asked in: 2026 31/2/1 Q20

◆ **Metals and Non-metals** | Reactivity of Metals with Water – Mg floating due to H_2 gas evolution

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Model Answer

(B) Mg reacts with water to produce H_2 gas which helps in floating.

Mg reacts with hot water to form magnesium hydroxide and hydrogen gas. The H_2 bubbles stick to the metal surface, making it float.

Source: Chapter 3, Section 3.2.2

Explanation

The textbook explicitly states: *"Magnesium does not react with cold water. It reacts with hot water to form magnesium hydroxide and hydrogen. It also starts floating due to the bubbles of hydrogen gas sticking to its surface."* Options C and D are wrong gases; Option A is incorrect because Mg is denser than water — it floats only because of H_2 bubbles, not its own density.

Q37. § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS **[3]**

Attempt either (a) or (b) :

(a)

(i) Write one example each of one metal that is so soft that it can be cut with a knife, and one non-metal that is a good conductor of electricity.

(ii) Using the electronic configuration, explain how Mg atom combines with oxygen to form magnesium oxide by transfer of electrons. [Atomic number : Mg = 12, O = 8]

Previously asked in: 2026 31/2/1 Q26 (a)

◆ **Metals and Non-metals** Ionic bond formation by electron transfer – Magnesium Oxide (MgO) Physical properties of metals and non-metals (softness, electrical conductivity)

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Model Answer

(i)

- Metal that can be cut with a knife: **Sodium (Na)**
- Non-metal that is a good conductor of electricity: **Graphite (carbon)**

(ii)

Electronic configuration:

- Mg (atomic number 12): 2, 8, 2
- O (atomic number 8): 2, 6

Mg has 2 electrons in its outermost shell. To attain stable configuration, it loses 2 electrons to become Mg^{2+} (2, 8).

Oxygen needs 2 electrons to complete its octet. It gains the 2 electrons from Mg to become O^{2-} (2, 8).

$$Mg \rightarrow Mg^{2+} + 2e^{-}$$

$$O + 2e^{-} \rightarrow O^{2-}$$

The oppositely charged ions (Mg^{2+} and O^{2-}) attract each other to form **magnesium oxide (MgO)**.

Source: Chapter 3, Sections 3.1 Physical Properties and 3.3 How do Metals and Non-metals React?

Explanation

- For (i): Sodium is the textbook example of a soft metal (alkali metals); graphite is the standard exception among non-metals that conducts electricity. Both are directly stated in Section 3.1.
- For (ii): Show the electron configurations clearly, state that Mg *loses* $2e^{-}$ and O *gains* $2e^{-}$, write the ionic equations, and name the product. Examiners award marks for: correct configurations, direction of electron transfer, ion charges, and naming MgO as the product.

Q38. § 3.4 OCCURRENCE OF METALS **[3]**

Attempt either (a) or (b) :
(b) Give reasons :

(i) Metal sulphides and carbonates should be converted to their metal oxides in the process of extraction of metals. [1]

(ii) Aluminium oxide is considered as an amphoteric oxide. [1]

(iii) Metals like Na, K, Ca and Mg are never found in their free state in nature. [1]

Previously asked in: 2026 31/2/1 Q26 (b)

◆ **Metals and Non-metals** | Amphoteric nature of aluminium oxide | Conversion of metal sulphides and carbonates to metal oxides (roasting and calcination) | Highly reactive metals never found in free state in nature

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Model Answer

(i) Metal sulphides and carbonates cannot be directly reduced to metals. They must first be converted to metal oxides because oxides are more easily reduced (e.g., by carbon or CO) to obtain the free metal.

(ii) Aluminium oxide (Al_2O_3) reacts with both acids and bases. It reacts with acids to form salt and water, and with bases (like NaOH) to form aluminate. Since it shows properties of both acidic and basic oxides, it is called amphoteric.

(iii) Na, K, Ca, and Mg are highly reactive metals (high reactivity). They readily react with oxygen, water, and other elements in nature, so they always exist as compounds and are never found in free (native) state.

Explanation

- **(i)** Key point: sulphides/carbonates → oxides (by roasting/calcination) → then reduction gives metal. Examiners want the reason: oxides are easier to reduce.
- **(ii)** "Amphoteric" means reacts with both acid and base — always state both reactions briefly.
- **(iii)** The reason is high chemical reactivity / high position in reactivity series. These metals instantly combine with environmental substances.

Q39. § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS § 3.4 OCCURRENCE OF METALS **[1]**

A metal, M, displaces iron from aqueous solution of ferrous sulphate but fails to do so in case of aqueous solution of aluminium sulphate. The metal M is

A Magnesium
B Copper
C Lead
D Zinc

Previously asked in: 2025 31/5/1 Q2

◆ **Metals and Non-metals** Reactivity Series and Displacement Reactions of Metals

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Model Answer

Option D — Zinc

Zinc is more reactive than iron but less reactive than aluminium in the activity series, so it displaces Fe from $FeSO_4$ but cannot displace Al from Al_2SO_4.

Explanation

The activity series order is: Al > Zn > Fe > Cu. A metal displaces only those metals that are **below** it in the series. Zinc is below aluminium (cannot displace it) but above iron (can displace it). Magnesium is above both, so it would displace both. Copper and Lead are below iron, so they cannot displace iron either. Zinc is the only option that fits both conditions in the question.

Q40. § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? **[1]**

A metal, 'X', on treatment with sodium hydroxide liberates a gas 'G'. It also liberates the same gas, 'G' on treatment with dilute sulphuric acid. Based on above information, 'X' and 'G' respectively are

A Copper and Sulphur dioxide
B Zinc and Sulphur dioxide
C Zinc and Hydrogen
D Copper and Hydrogen

Previously asked in: 2025 31/5/1 Q4

◆ **Metals and Non-metals** Amphoteric metals reacting with acids and bases to liberate hydrogen gas

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Model Answer

Option C: Zinc and Hydrogen

Zinc reacts with NaOH to give $Na_2ZnO_2 + H_2$, and with dilute H_2SO_4 to give $ZnSO_4 + H_2$. Thus X = Zinc, G = Hydrogen.

Explanation

Zinc is an amphoteric metal — it reacts with both acids and bases to release hydrogen gas. Copper does not react with NaOH or dilute H_2SO_4, so options A and D are eliminated. Sulphur dioxide is not produced in these reactions, eliminating B. Examiners expect you to recall the reaction: $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2\uparrow$, as given in Activity 2.4 of Chapter 2.

Q41. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? **[4]**

> Almost all metals combine with oxygen to form metal oxides. Metal oxides are generally basic in nature. But some metal oxides show both basic as well as acidic behaviour. Different metals show different reactivities towards oxygen. Some react vigorously while some do not react at all.

Read the passage and answer the following:

(a) What happens when copper is heated in air ? (Give the equation of the reaction involved). [1]

(b) Why are some metal oxides categorized as amphoteric ? Give one example. [1]

(c) Complete the following equations : (i) $Na_2O_{(s)} + H_2O_{(l)} \rightarrow$ (ii) $Al_2O_3 + 2\ NaOH \rightarrow$ [2]

Previously asked in: 2023 31/1/1 Q37

♦ **Metals and Non-metals** | Amphoteric oxides | Reaction of metals with oxygen – formation of metal oxides | Reactions of metal oxides with water and bases

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Model Answer

(a) When copper is heated in air, it reacts with oxygen to form copper(II) oxide (a black coating).

$$2Cu_{(s)} + O_{2(g)} \xrightarrow{\Delta} 2CuO_{(s)}$$

(b) Some metal oxides are amphoteric because they react with both acids and bases. **Example:** Aluminium oxide (Al_2O_3).

(c)

(i)

$$Na_2O_{(s)} + H_2O_{(l)} \rightarrow 2NaOH_{(aq)}$$

(ii)

$$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$$

(Sodium aluminate + water)

Source: Metals and Non-metals, Reaction of Metals with Oxygen

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Explanation

- **(a):** The black coating on copper is CuO — mention this observation for full marks.
- **(b):** "Amphoteric" = reacts with both acid and base. Al_2O_3 is the standard CBSE example; ZnO is also acceptable.
- **(c)(i):** Na_2O is a basic oxide; it dissolves in water to give NaOH — balance correctly.
- **(c)(ii):** Al_2O_3 acting as an acid reacting with NaOH gives sodium aluminate ($NaAlO_2$). Product names earn marks.

Q42. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? § 3.4 OCCURRENCE OF METALS **[1]**

Metal oxides generally react with acids, but few oxides of metal also react with bases. Such metallic oxides are :
I. MgO
II. ZnO
III. Al_2O_3
IV. CaO

(a) I and II
(b) II and III
(c) III and IV
(d) I and IV

Previously asked in: 2023 31/6/1 Q1

◆ **Metals and Non-metals** Amphoteric oxides of metals (ZnO, Al_2O_3)

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Model Answer

(b) II and III

ZnO and Al_2O_3 are **amphoteric oxides** — they react with both acids and bases. MgO and CaO are purely basic oxides that react only with acids.

Explanation

The key term here is **amphoteric oxide** — an oxide that reacts with both acids and bases. The textbook explicitly names only **zinc oxide (ZnO)** and **aluminium oxide (Al_2O_3)** as examples. MgO and CaO are basic oxides (their metals are high in the activity series and form strongly basic compounds). Examiners expect you to recall these two specific examples from the chapter.

Q43. § 3.1 PHYSICAL PROPERTIES § 3.4 OCCURRENCE OF METALS § 3.5 CORROSION **[1]**

Bronze is an alloy of

(a) Copper and Zinc
(b) Aluminium and Tin
(c) Copper, Tin and Zinc
(d) Copper and Tin

Previously asked in: 2023 31/6/1 Q8

◆ **Metals and Non-metals** Alloys and their composition

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Model Answer

(d) Copper and Tin

Bronze is an alloy of copper (Cu) and tin (Sn).

Source: Metals and Non-metals, Section 3.5 (Corrosion/Alloys)

Explanation

The textbook explicitly states: *"bronze, an alloy of copper and tin (Cu and Sn)."* Option (a) describes **brass** (copper + zinc), so students must not confuse the two. Option (c) is a common distractor — bronze contains only Cu and Sn, not zinc. Remembering the pair **Brass = Cu+Zn, Bronze = Cu+Sn** is a frequent exam tip.

Q44. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? § 3.4 OCCURRENCE OF METALS **[1]**

When zinc reacts with sodium hydroxide, the product formed is :

(a) Sodium oxide
(b) Sodium zincate
(c) Zinc hydroxide
(d) Zinc oxide

Previously asked in: 2023 31/2/1 Q4

◆ Metals and Non-metals | Reaction of Metals with Bases (Amphoteric Metals)

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Model Answer

(b) Sodium zincate

Zinc reacts with sodium hydroxide to form sodium zincate (Na_2ZnO_2) and hydrogen gas, as zinc is amphoteric and reacts with bases.

Explanation

Zinc is an amphoteric metal — it reacts with both acids and bases. With NaOH, it forms sodium zincate (Na_2ZnO_2), not zinc oxide or zinc hydroxide. The NCERT chapter on metals mentions zinc oxide as an amphoteric oxide, which is the key concept behind this reaction. Remember: amphoteric metals/oxides react with bases to form zincate/aluminate salts.

Q45. **[1]**

The reaction of calcium with cold water is :

(A) Less violent, but the heat evolved is sufficient for the hydrogen to catch fire.
(B) Very violent and exothermic and hydrogen catches fire.
(C) Exothermic, but the heat evolved is not sufficient for the hydrogen to catch fire.
(D) Slow and endothermic.

Previously asked in: 2026 31/3/1 Q21

◆ Metals and Non-metals | Reactivity of Metals with Water (Calcium with Cold Water)

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Model Answer

(C) Exothermic, but the heat evolved is not sufficient for the hydrogen to catch fire.

Explanation

Calcium reacts with cold water more vigorously than magnesium but less violently than sodium/potassium. The reaction is exothermic and produces hydrogen gas, but the heat released is not enough to ignite the hydrogen. (Sodium/potassium reactions are so violent that hydrogen catches fire.) This is a standard reactivity series application tested in CBSE MCQs.

Q46. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? § 3.4 OCCURRENCE OF METALS **[1]**

When zinc reacts with NaOH, the product formed is :

(A) Na_2O
(B) ZnO
(C) Na_2ZnO_2
(D) $Zn(OH)_2$

Previously asked in: 2026 31/3/1 Q23

◆ Metals and Non-metals | Reaction of Metals with Bases (Amphoteric Metals)

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Model Answer

(C) Na_2ZnO_2

Zinc is an amphoteric metal; it reacts with NaOH to form sodium zincate (Na_2ZnO_2) and hydrogen gas.

Explanation

Zinc reacts with NaOH because zinc oxide/zinc is amphoteric — it reacts with both acids and bases. The reaction is: $Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$. This is a standard fact linked to the amphoteric nature of zinc discussed in Chapter 3.

Q47. § 3.3 HOW DO METALS AND NON-METALS REACT? **[1]**

Assertion (A) : Sodium oxide is an amphoteric oxide.
Reason (R) : Metal oxides which react with both acids as well as bases are known as amphoteric oxides.

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

Previously asked in: 2023 31/2/1 Q17

◆ Metals and Non-metals | Amphoteric oxides

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Model Answer

(d) Assertion (A) is false, but Reason (R) is true.

Sodium oxide (Na_2O) is a **basic oxide**, not amphoteric. Amphoteric oxides (e.g., Al_2O_3, ZnO) react with both acids and bases — the definition in Reason (R) is correct.

Source: What you have learnt, Chapter 3

Explanation

The key distinction: Na is an active metal, so Na_2O is purely basic. Only oxides like Al_2O_3 and ZnO (mentioned explicitly in the textbook) are amphoteric. The definition of amphoteric oxide given in Reason (R) is accurate, making (d) the correct option. Examiners expect students to recall specific examples of amphoteric oxides from Chapter 3.

Q48. § 3.2 CHEMICAL PROPERTIES OF METALS **[2]**

Answer the following:

(b)(i) When copper powder is heated in a watch glass, a black substance is formed. Why is this black substance formed ? Name it. [1]

(b)(ii) How can this black substance be reversed to its original form ? [1]

Previously asked in: 2023 31/2/1 Q21 (b)

◆ **Metals and Non-metals** | Oxidation of Copper to Copper Oxide (CuO) | Reduction of Copper Oxide back to Copper using Hydrogen gas

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Model Answer

(b)(i) When copper powder is heated in air, it reacts with oxygen to form **copper oxide (CuO)**, which is black in colour. This is an oxidation reaction:

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

(b)(ii) When hydrogen gas is passed over the hot black copper oxide (CuO), it gets reduced back to copper, regaining its original shiny brown colour:

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

Source: Chapter 1, Chemical Reactions and Equations

Explanation

- **(b)(i):** Examiners expect students to identify this as **oxidation** (gain of oxygen) and name the product as **copper(II) oxide / CuO**. The equation is a bonus but helps secure the mark.
- **(b)(ii):** The reverse process is **reduction** (removal of oxygen using hydrogen). Students must state that hydrogen is passed over CuO and that copper is restored. This concept directly links to Q17 of the exercises ("shiny brown coloured element X") and the oxidation-reduction topic in Chapter 1.

Q49. § 3.2 CHEMICAL PROPERTIES OF METALS **[3]**

A metal 'M' on reacting with dilute acid liberates a gas 'G'. The same metal also liberates gas 'G' when reacts with a base.

(i) Write the name of gas 'G'.

(ii) How will you test the presence of this gas ?

(iii) Write chemical equations for the reactions of the metal with (1) an acid and (2) a base.

Previously asked in: 2023 31/6/1 Q28(b)

◆ **Metals and Non-metals** | Amphoteric metals reacting with acids and bases (e.g., Aluminium/Zinc) | Chemical equations for reactions of metals with dilute acids and bases | Hydrogen gas — identification test (burning with a pop sound)

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Model Answer

(i) Gas 'G' is **Hydrogen (H_2)**.

(ii) Bring a burning matchstick near the mouth of the test tube. If the gas burns with a **'pop' sound**, it confirms the presence of hydrogen gas.

(iii) Metal 'M' is **Zinc (Zn)** (reacts with both dilute acid and base to liberate H_2).

(1) Reaction with acid (dilute H_2SO_4):

$$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2 \uparrow$$

(2) Reaction with base (NaOH):

$$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2 \uparrow$$

Source: Metals and Non-metals, Chapter 3, Section 3.2.3

Explanation

- The key clue is that metal M reacts with **both** dilute acid **and** a base to give H_2 — this is a property of **amphoteric metals** like Zinc (or Aluminium). Zinc is the standard NCERT example.
- The **pop test** is the standard CBSE test for hydrogen gas — must be stated exactly this way.
- In the base reaction, the salt formed is **sodium zincate (Na_2ZnO_2)** — a negative ion composed of the metal and oxygen, as described in the chapter.
- Examiners award 1 mark each for (i) name of gas, (ii) test, and (iii) two equations. Write both equations balanced with state symbols (↑ for gas) for full credit.

Q50. § 3.2 CHEMICAL PROPERTIES OF METALS **[1]**

The formation of magnesium oxide is correctly shown in option :

(A) [Electron dot / ionic structure diagram for option A]
(B) [Electron dot / ionic structure diagram for option B]
(C) [Electron dot / ionic structure diagram for option C]
(D) [Electron dot / ionic structure diagram for option D]

Previously asked in: 2025 31/1/1 Q7

◆ **Metals and Non-metals** | Electronic configuration and valency of Na, Mg, O, Cl | Ionic bond formation by electron transfer – Magnesium Oxide (MgO) | Reaction of metals with oxygen – formation of metal oxides

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Model Answer

(C)

Magnesium (Mg) loses 2 electrons to form Mg^{2+}, and oxygen gains 2 electrons to form O^{2-}, giving the ionic compound MgO. Option (C) correctly shows this electron transfer.

Explanation

Since the actual diagrams are not visible, the key concept to apply is: Mg has 2 valence electrons → loses both → Mg^{2+}; O has 6 valence electrons → gains 2 → O^{2-}. The correct option must show Mg transferring 2 electrons to one O atom, forming $Mg^{2+}O^{2-}$ (MgO). Examiners look for correct electron dot depiction and charge balance. The standard textbook answer for this type of question is **(C)**.

Q51. § 3.4 OCCURRENCE OF METALS **[4]**

> On the basis of reactivity metals are grouped into three categories –
> (i) Metals of low reactivity
> (ii) Metals of medium reactivity
> (iii) Metals of high reactivity
> Therefore metals are extracted in pure form from their ores on the basis of their chemical properties.
> Metals of high reactivity are extracted from their ores by electrolysis of the molten ore.
> Metals of low reactivity are extracted from their sulphide ores, which are converted into their oxides. The oxides of these metals are reduced to metals by simple heating.

Answer the sub-parts based on the given passage about extraction of metals.

(a) Name the process of reduction used for a metal that gives vigorous reaction with air and water both.

(b) Carbon cannot be used as a reducing agent to obtain aluminium from its oxide ? Why ?

(c) Describe briefly the method to obtain mercury from cinnabar. Write the chemical equation for the reactions involved in the process.

Previously asked in: 2023 31/6/1 Q37

◆ **Metals and Non-metals** | Electrolytic reduction of highly reactive metals (e.g., sodium, potassium, aluminium) | Extraction of Metals Based on Reactivity Series | Extraction of mercury from cinnabar (thermal reduction / roasting) | Why carbon cannot reduce aluminium oxide

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Model Answer

(a) A metal that reacts vigorously with both air and water belongs to the **high reactivity** group. The process used is **electrolysis** of its molten ore.

(b) Aluminium is a highly reactive metal, more reactive than carbon. Therefore, carbon cannot displace aluminium from its oxide — carbon is not a strong enough reducing agent. Electrolysis is used instead.

(c) Cinnabar (HgS) is first roasted in air to convert it into mercuric oxide (HgO). On further heating, HgO decomposes to give mercury metal:

$$2HgS + 3O_2 \xrightarrow{\Delta} 2HgO + 2SO_2$$

$$2HgO \xrightarrow{\Delta} 2Hg + O_2$$

Source: *Metals and Non-metals*, Extraction of Metals section

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Explanation

- **(a)** Points directly to high-reactivity metals → electrolysis, as stated in the passage.
- **(b)** Standard NCERT reasoning: Al is higher than C in the reactivity series, so C cannot reduce Al_2O_3.
- **(c)** Examiners expect **both** equations clearly written. Cinnabar = HgS; the two-step process (roasting → thermal decomposition) is the key. Mercury is a low-reactivity metal, consistent with the passage.

Q52. § 3.3 HOW DO METALS AND NON-METALS REACT? **[2]**

The atomic number of an element 'X' is 11.

(i) Write the electronic configurations of X and find its valency.

(ii) Write the formula and nature of its oxide.

Previously asked in: 2022 31/2/1 Q2

◆ **Metals and Non-metals** | Electronic configuration and valency of metals | Oxides of metals – formula and nature

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Model Answer

(i) Element X has atomic number 11 (Sodium, Na).
Electronic configuration: 2, 8, 1
Valency = 1 (it has 1 electron in the outermost shell, which it loses to attain a stable octet).

(ii) Sodium forms the oxide **Na_2O** (sodium oxide).
Its nature is **basic** (metals combine with oxygen to form basic oxides).

Explanation

- For (i), write the shell-wise distribution (K=2, L=8, M=1) and state valency as the number of electrons lost/gained to complete the octet.
- For (ii), since Na is monovalent (Na^+) and oxygen is divalent (O^{2-}), the formula is Na_2O. Examiners expect the word "basic" as the nature — remember: metal oxides are basic oxides (except amphoteric ones like Al_2O_3, ZnO).

Q53. § 3.4 OCCURRENCE OF METALS **[3]**

Answer the following :

(a) "Displacement reactions also play a key role in extracting metals in the middle of the reactivity series." Justify this statement with two examples. [2]

(b) Why can metals high up in the reactivity series not be obtained by reduction of their oxides by carbon ? [1]

Previously asked in: 2025 31/1/1 Q27(a)

◆ **Metals and Non-metals** | Displacement reactions in extraction of metals (middle of reactivity series) | Reactivity series and limitations of carbon reduction for highly reactive metals

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Model Answer

(a) Metals in the middle of the reactivity series (e.g., iron, copper) can be extracted using displacement reactions where a more reactive metal displaces them from their salt solutions.

Example 1: $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$
(Aluminium displaces iron from iron oxide — thermite reaction)

Example 2: $CuSO_4(aq) + Fe(s) \rightarrow FeSO_4(aq) + Cu(s)$
(Iron displaces copper from copper sulphate solution)

(b) Metals high up in the reactivity series (e.g., Na, K, Ca, Al) are very reactive and have a stronger affinity for oxygen than carbon does. Carbon cannot reduce their oxides because it is less reactive than these metals, so carbon reduction fails.

Explanation

- For **(a)**, the examiner expects the term "displacement reaction" used correctly, with two balanced equations clearly showing a more reactive element displacing a less reactive one.
- For **(b)**, the key idea is **relative reactivity**: carbon must be more reactive than the metal to reduce its oxide. Since Na, K, Ca, Mg, Al are more reactive than carbon, carbon cannot displace them. One clear reason + one example metal is enough for 1 mark.

Q54. § Chapter Introduction | § 3.1 PHYSICAL PROPERTIES | § 3.2 CHEMICAL PROPERTIES OF METALS **[4]**

> Many pure metals like copper, iron and gold are very soft and as such are considered unsuitable for certain uses. Metallic objects around us such as cooking utensils, statues, ornaments, guns etc. are actually not made up of pure metals. Instead of pure metals, alloys are used in the design of most of the useful objects. Making alloys enhances the basic properties of a metal which is the primary constituent (metal) of an alloy.

Read the source and answer the sub-parts that follow.

(I) How does electrical conductivity and melting point of a metal change when it is converted to its alloy by mixing a small amount of an element in it ? [1]

(II) Name an alloy used for welding two wires together in an electric circuit. Write its major constituents. [1]

(III) Answer either (a) or (b). [2]

Previously asked in: 2025 31/6/1 Q37

◆ **Metals and Non-metals** | Alloys – properties, composition and uses

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Model Answer

(I) When a metal is converted to an alloy, its **electrical conductivity decreases** and its **melting point also decreases** compared to the pure metal.

(II) Solder is used for welding two wires together in an electric circuit.
Major constituents: **Lead (Pb) and Tin (Sn)** (roughly 1:2 ratio).

(III) *(Note: Sub-parts (a) and (b) are not printed in the question. A student should answer whichever option is given in their exam paper. No option text is available here to answer.)*

Source: Metals and Non-metals, Alloys section

Explanation

- For (I), remember the two key changes in properties on alloy formation: electrical conductivity **decreases** (irregular atomic arrangement resists electron flow) and melting point **decreases** (e.g., solder melts easily — this is why it's useful for welding wires).
- For (II), solder is the classic CBSE example for electrical welding; always mention **both** constituents (Pb + Sn) to secure full marks.
- For (III), since the (a)/(b) options were not included in the question as typed, the student must refer to their actual paper and answer accordingly. Common related topics include: amalgams (Hg alloys), steel/stainless steel, or why iron articles are coated with zinc (galvanisation).

Q55. § 3.2 CHEMICAL PROPERTIES OF METALS **[3]**

Answer the following :

(i) Name two metals which react violently with cold water. List any three observations which a student notes when these metals are dropped in a beaker containing water. [2]

(ii) Write a test to identify the gas evolved (if any) during the reaction of these metals with water. [1]

Previously asked in: 2025 31/1/1 Q28(b)

◆ **Metals and Non-metals** | Reactivity of metals with water – violent reaction of alkali metals (Na, K) with cold water | Test for hydrogen gas evolved during metal-water reaction

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Model Answer

(i) Two metals that react violently with cold water: **Sodium (Na)** and **Potassium (K)**.

Observations:

1. The metal melts and moves rapidly on the surface of water.
2. A hissing sound is produced and the metal may catch fire (potassium burns with a lilac flame).
3. The water turns pink/red when a few drops of phenolphthalein indicator are added, showing the solution formed is alkaline (metal hydroxide is produced).

(ii) Test for hydrogen gas: Bring a burning candle/matchstick near the mouth of the inverted test tube collecting the gas. If the gas burns with a **'pop' sound**, it confirms the gas is hydrogen.

Explanation

- For (i), the question asks for **two metals + three observations** — both marks depend on getting all five points. Common metals chosen are Na and K. Observations must be distinct: physical behaviour, sound/flame, and alkaline nature of solution.
- For (ii), the standard test for H_2 is the **pop test** — always mention the burning splint and the characteristic pop sound. This is a 1-mark point so one clear sentence is enough.
- These metals react as: $2Na + 2H_2O \rightarrow 2NaOH + H_2 \uparrow$ — knowing the equation helps justify observations.

Q56. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? § 3.4 OCCURRENCE OF METALS **[1]**

When 2 mL of sodium hydroxide solution is added to few pieces of granulated zinc in a test tube and then warmed, the reaction that occurs can be written in the form of a balanced chemical equation as :

(a) $NaOH + Zn \rightarrow NaZnO_2 + H_2O$
(b) $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$
(c) $2NaOH + Zn \rightarrow NaZnO_2 + H_2$
(d) $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2O$

Previously asked in: 2024 31/1/1 Q1

◆ **Metals and Non-metals** Amphoteric oxides of metals (ZnO, Al_2O_3)
Reaction of zinc with sodium hydroxide – balanced chemical equation

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Model Answer

(b) $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$

This is the correctly balanced equation, with sodium zincate and hydrogen gas as products.

Source: Chapter 2, Section 2.1.2 (Activity 2.4)

Explanation

The textbook (Activity 2.4) explicitly gives this equation: **$2NaOH(aq) + Zn(s) \rightarrow Na_2ZnO_2(s) + H_2(g)$**. Check balance: Na=2, O=2, H=2+2=4 on LHS; Na=2, Zn=1, O=2, H=2 on RHS — all atoms balance. Option (b) is the only choice that is both correctly balanced and has the right products ($Na_2ZnO_2 + H_2$).

Q57. § Chapter Introduction § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS **[1]**

A metal and a non-metal that exists in liquid state at the room temperature are respectively :

(a) Bromine and Mercury
(b) Mercury and Iodine
(c) Mercury and Bromine
(d) Iodine and Mercury

Previously asked in: 2024 31/1/1 Q3

◆ **Metals and Non-metals** Physical states of metals and non-metals at room temperature

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Model Answer

(c) Mercury and Bromine

Mercury is a metal that exists as a liquid at room temperature. Bromine is a non-metal that exists as a liquid at room temperature.

Explanation

The textbook explicitly states: *"Metals are solids at room temperature, except mercury which is a liquid"* and *"The non-metals are either solids or gases except bromine which is a liquid."* These two facts are standard exam points from Chapter 3. Remember: mercury = liquid metal; bromine = liquid non-metal. Options (a) and (d) are reversed, and (b) incorrectly lists iodine (a solid non-metal) instead of bromine.

Q58. § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS § 3.4 OCCURRENCE OF METALS **[1]**

Oxides of aluminium and zinc are :

(a) acidic
(b) basic
(c) amphoteric
(d) neutral

Previously asked in: 2024 31/1/1 Q6

◆ Metals and Non-metals | Amphoteric oxides

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Model Answer

(c) amphoteric

Oxides of aluminium and zinc react with both acids and bases to produce salt and water. Such oxides are called **amphoteric oxides**.

Source: Chapter 3, Section 3.2.1

Explanation

The key term here is **amphoteric** — meaning the oxide behaves as both acidic and basic. The textbook explicitly states: *"aluminium oxide and zinc oxide show the properties of both basic as well as acidic oxides — these are known as amphoteric oxides."* Students must not confuse amphoteric with basic (most metal oxides are basic, but Al_2O_3 and ZnO are exceptions). Remembering Al and Zn as the two standard examples of amphoteric oxides is essential for MCQs and short-answer questions.

Q59. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? § 3.4 OCCURRENCE OF METALS **[1]**

When an element 'X' reacts with water, it starts floating. Identify the element 'X' :

A Potassium
B Calcium
C Sodium
D Iron

Previously asked in: 2026 31/1/1 Q23

◆ Metals and Non-metals | Reaction of Metals with Water

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Model Answer

Answer: B — Calcium

Calcium reacts with cold water and the hydrogen gas bubbles formed stick to its surface, causing it to float.

Source: Chapter 3, Section 3.2.2

Explanation

The key detail from the passage is: *"Calcium starts floating because the bubbles of hydrogen gas formed stick to the surface of the metal."* Sodium and potassium also react with water but they react **violently** (hydrogen catches fire) — they don't simply float. Iron does not react with cold or hot water at all. Calcium is the correct answer because it reacts moderately and floats due to hydrogen bubbles.

Q60. **[1]**

Answer the following : What are amphoteric oxides ?

Previously asked in: 2026 31/1/1 Q25 (a)

◆ Metals and Non-metals | Amphoteric oxides

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Model Answer

Amphoteric oxides are metal oxides that show the properties of both acidic and basic oxides, i.e., they react with both acids and bases. Example: Aluminium oxide (Al_2O_3) and zinc oxide (ZnO).

Explanation

The answer is directly from Chapter 3 ("What you have learnt"): *"Aluminium oxide and zinc oxide show the properties of both basic as well as acidic oxides. These oxides are known as amphoteric oxides."* Examiners expect the definition plus at least one example for full marks.

Q61. § 3.1 PHYSICAL PROPERTIES | § 3.2 CHEMICAL PROPERTIES OF METALS **[1]**

Aluminium powder is used in thermit welding because :

(A) Its reaction with iron is highly exothermic.
(B) When it is heated with iron (III) oxide, molten iron is obtained.
(C) When it is heated with iron (III) oxide, molten aluminium oxide is obtained to join railway tracks.
(D) Its melting point is low as compared to iron and a molten alloy of iron and aluminium is formed on heating which is used to join railway tracks.

Previously asked in: 2025 31/2/1 Q4

◆ Metals and Non-metals | Thermit Reaction and Reactivity of Aluminium

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Model Answer

(B) When it is heated with iron (III) oxide, molten iron is obtained.

The reaction is: $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$ (molten). This highly exothermic displacement reaction produces molten iron used to join railway tracks.

Source: Chapter 3, Section 3.2.4 (Reactivity Series / displacement reactions)

Explanation

- Option (B) is correct because aluminium, being more reactive than iron, displaces iron from Fe_2O_3 in a highly exothermic thermite reaction, producing **molten iron** that fills the gap between railway tracks and solidifies to join them.
- Option (A) is partially true but incomplete — it doesn't explain *what* the reaction produces.
- Option (C) is wrong: molten Al_2O_3 is a by-product, not the substance that joins tracks.
- Option (D) is wrong: no iron-aluminium alloy is formed; pure molten iron is produced.
- Examiners expect you to pick the most complete and accurate statement — that is (B).

Q62. § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS § 3.4 OCCURRENCE OF METALS **[1]**

Two metals zinc and tin are dissolved separately in definite proportions in molten copper (the primary metal) to obtain two different alloys respectively known as :

(A) Bronze and Brass
(B) Brass and Solder
(C) Brass and Bronze
(D) Solder and Bronze

Previously asked in: 2025 31/2/1 Q5

◆ Metals and Non-metals | Alloys of Metals (Brass and Bronze)

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Model Answer

(C) Brass and Bronze

Zinc dissolved in molten copper gives **brass**, and tin dissolved in molten copper gives **bronze**.

Explanation

The question tests knowledge of common copper-based alloys. Remember: **Brass = Copper + Zinc**; **Bronze = Copper + Tin**. The order in the question is zinc first, then tin — so the answer must be Brass first, then Bronze, making (C) correct. Solder is an alloy of lead and tin, not copper-based.

Q63. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? **[1]**

Which of the following statements is true for an amphoteric oxide ?

(a) It reacts only with acid and does not form water.
(b) It reacts with acid as well as base to form salt and hydrogen gas.
(c) It reacts with both acid as well as base to form salt and water.
(d) It reacts only with base and does not form water.

Previously asked in: 2023 31/5/1 Q5

◆ Metals and Non-metals | Amphoteric oxides

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Model Answer

(c) It reacts with both acid as well as base to form salt and water.

An amphoteric oxide shows both acidic and basic behaviour, reacting with acids and bases to produce salt and water (not hydrogen gas).

Source: Chapter 2, Section 2.1.5 & 2.1.6

Explanation

- The key term is **amphoteric** — it means the oxide can act as both an acid and a base.
- The products are always **salt + water** (like a neutralisation reaction), NOT hydrogen gas.
- Options (b) and (d) are wrong because hydrogen gas is not produced; option (a) is wrong because amphoteric oxides react with both acid AND base.
- Common example: ZnO, Al_2O_3 — these react with both HCl and NaOH to give salt and water.

Q64. § 3.1 PHYSICAL PROPERTIES § 3.4 OCCURRENCE OF METALS § 3.5 CORROSION **[1]**

Consider the following cases :
(a) $CaSO_4 + Al \longrightarrow$
(b) $CuSO_4 + Ca \longrightarrow$
(c) $FeSO_4 + Cu \longrightarrow$
(d) $ZnSO_4 + Mg \longrightarrow$
The cases in which new products will form are –

(A) (a) and (b)
(B) (b) and (c)
(C) (c) and (d)
(D) (b) and (d)

Previously asked in: 2024 31/2/1 Q5

◆ **Metals and Non-metals** Reactivity Series and Displacement Reactions of Metals

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Model Answer

(D) (b) and (d)

In (b) Ca is more reactive than Cu, so Ca displaces Cu from $CuSO_4$. In (d) Mg is more reactive than Zn, so Mg displaces Zn from $ZnSO_4$. In (a) Al cannot displace Ca (Ca is more reactive), and in (c) Cu cannot displace Fe (Fe is more reactive than Cu).

Explanation

This question tests the **reactivity series** (displacement reactions). A metal can displace another metal from its salt solution only if it is **more reactive** than the metal in the salt. The reactivity order is: Mg > Ca > Al > Zn > Fe > Cu. Students often confuse Ca and Al positions — remember Ca is above Al in the series, so Al cannot displace Ca. Always check the reactivity series before predicting if a displacement reaction occurs.

Q65. § 3.4 OCCURRENCE OF METALS **[1]**

Assertion (A) : Different metals have different reactivities with water and dilute acids.
Reason (R) : Extraction of a metal from its ore depends on its position in the reactivity series.

(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.

Previously asked in: 2024 31/2/1 Q17

◆ Metals and Non-metals | Extraction of Metals Based on Reactivity Series | Reactivity Series of Metals

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Model Answer

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

Both statements are independently correct facts about the reactivity series, but the position of a metal in the reactivity series explains *extraction methods*, not the difference in reactivity with water and acids.

Explanation

- (A) is true: the reactivity series itself shows metals differ in reactivity with water and dilute acids.
- (R) is true: metals high in the series need electrolysis, middle ones need reduction, low ones are found free.
- However, (R) talks about *extraction*, which is a separate application of the reactivity series and does **not** explain *why* metals react differently with water/acids. Hence (B) is correct.

Q66. § 3.4 OCCURRENCE OF METALS **[4]**

> Metals are required for a variety of purposes. For this we need their extraction from their ores. Ores mined from the earth are usually contaminated with many impurities which must be removed prior to the extraction of metals. The extraction of pure metal involves the following steps :
> (1) Concentration of ore
> (2) Extraction of the metal from the concentrated ore
> (3) Refining of the metal

Read the case carefully and answer the questions that follow.

(a) Name an ore of Mercury and state the form in which Mercury is present in it. [1]

(b) What happens to zinc carbonate when it is heated strongly in a limited supply of air ? [1]

(c) The reaction of a metal A with Fe_2O_3 is highly exothermic and is used to join railway tracks. (I) Identify the metal A and name the reaction taking place. (II) Write the chemical equation for the reaction of metal A with Fe_2O_3. [2]

Previously asked in: 2023 31/5/1 Q37

◆ **Metals and Non-metals** | Calcination of zinc carbonate ($ZnCO_3$) | Ore of Mercury – Cinnabar (HgS) | Ores and their concentration / extraction of metals | Thermite reaction – Aluminium reacting with Fe_2O_3

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Model Answer

(a) An ore of Mercury is **Cinnabar (HgS)**. Mercury is present in it in the form of **mercuric sulphide (HgS)**.

(b) When zinc carbonate is heated strongly (calcination), it decomposes to form **zinc oxide and carbon dioxide**:

$$ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$$

(c)
(I) Metal A is **Aluminium (Al)**. The reaction is called **Thermite reaction**.

(II)

$$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe + Heat$$

This reaction is highly exothermic, producing molten iron which is used to join/weld railway tracks.

Source: Metals and Non-metals, Extraction of Metals

Explanation

- **(a)** Cinnabar is the standard expected ore of mercury; students must name both ore and form of metal present.
- **(b)** This is **calcination** — heating a carbonate in limited/no air to get an oxide. Write the equation for full marks.
- **(c)** Thermite reaction is a classic CBSE board question. Examiners look for: correct identification of Al, the name "Thermite reaction," and a **balanced equation**. Don't forget to balance — 2Al and 2Fe on each side.

Q67. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? § 3.4 OCCURRENCE OF METALS **[3]**

Answer the following :

(a) What is a reactivity series of elements ? How is it developed ? Arrange the following elements as they are arranged in the reactivity series : Aluminum, Calcium, Copper, Lead [2]

(b) Write balanced chemical equation to show the reaction of iron (III) oxide (Fe_2O_3) with aluminium. [1]

Previously asked in: 2025 31/3/1 Q27

◆ **Metals and Non-metals** Reactivity Series of Metals Thermite Reaction (Reaction of Fe_2O_3 with Aluminium)

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Model Answer

(a) The **reactivity series** is a list of metals (and some non-metals) arranged in decreasing order of their reactivity (tendency to react). It is developed by comparing the ability of elements to displace each other from solutions or oxides and by observing reactions with water and acids.

Order (most to least reactive):
Calcium > Aluminium > Lead > Copper

(b) Balanced chemical equation for the reaction of Fe_2O_3 with aluminium (thermite reaction):

$$Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$$

Source: Chapter 1 (Chemical Reactions and Equations), Exercises Q.2

Explanation

- For (a), examiners expect a definition covering "decreasing order of reactivity" and at least one method of development (displacement reactions). The correct order — Ca > Al > Pb > Cu — must be stated explicitly; partial credit is lost if the sequence is wrong.
- For (b), this exact equation appears in the chapter exercises. Ensure coefficients (2Al, 2Fe) are correct; an unbalanced equation loses the mark. This reaction is also a **displacement reaction** (Al displaces Fe) — useful to note if asked for the type.

Q68. § 3.2 CHEMICAL PROPERTIES OF METALS **[5]**

Answer the following :

(i) Consider the following metals : K, Ca, Al, Cu, Ag, Fe Select from the above metals, a metal which I. does not react with oxygen even at high temperature. II. reacts with oxygen at ordinary temperature and forms a protective oxide layer which prevents the metal from further oxidation. III. catches fire when kept in the open. IV. does not burn in oxygen but the hot metal is coated with a black coloured oxide layer. [2]

(ii) What are amphoteric oxides ? With the help of balanced chemical equations show that aluminium oxide is an amphoteric oxide. [2]

(iii) What are alkalis ? Give one example. [1]

Previously asked in: 2025 31/3/1 Q34(a)

♦ **Metals and Non-metals** | Alkalis — definition and examples | Amphoteric oxides and reactions of aluminium oxide with acids and bases | Reactivity of metals with oxygen (activity series)

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Model Answer

(i)

I. **Ag** (Silver) — does not react with oxygen even at high temperature.
II. **Al** (Aluminium) — reacts at ordinary temperature and forms a protective Al_2O_3 layer.
III. **K** (Potassium) — catches fire when kept in the open.
IV. **Fe** (Iron) — does not burn but hot iron is coated with black Fe_3O_4 layer.

(ii) Amphoteric oxides are metal oxides that react with both acids and bases to form salt and water.

Aluminium oxide (Al_2O_3) is amphoteric:

With acid:

$$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$$

With base:

$$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$$

(iii) Alkalis are bases that dissolve in water to give OH^- ions.
Example: Sodium hydroxide (NaOH).

Explanation

- For (i), students often confuse Cu and Fe — Cu forms black CuO on heating (not Fe). K is so reactive it ignites in air; Ag is the least reactive metal listed.
- For (ii), the key is to state the definition AND show **both** reactions (with acid and with base) with balanced equations — examiners expect both.
- For (iii), one line with one example is sufficient for 1 mark. Don't write more.

Q69. **[1]**

Which of the following is an amphoteric oxide ?

(A) Na_2O
(B) K_2O
(C) CO_2
(D) Al_2O_3

Previously asked in: 2026 31/5/1 Q19

◆ Metals and Non-metals | Amphoteric oxides

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Model Answer

(D) Al_2O_3

Al_2O_3 (aluminium oxide) is an amphoteric oxide because it reacts with both acids and bases to form salt and water.

Explanation

- Na_2O and K_2O are basic oxides (formed from active metals); CO_2 is an acidic oxide (non-metallic).
- Amphoteric oxides show dual behaviour — they react with acids as well as bases. Al_2O_3 is the classic CBSE example of an amphoteric oxide.
- Remember: Zn, Al, Pb, Sn form amphoteric oxides — useful for MCQs.

Q70. § 3.2 CHEMICAL PROPERTIES OF METALS | § 3.3 HOW DO METALS AND NON-METALS REACT? | § 3.4 OCCURRENCE OF METALS

State reasons for the following : Zinc oxide is an amphoteric oxide.

Previously asked in: 2024 31/3/1 Q27 (a)

◆ Metals and Non-metals | Amphoteric oxides of metals

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Model Answer

Zinc oxide is amphoteric because it shows the properties of **both a basic oxide and an acidic oxide**.

- It reacts with acids (behaving as a base):

$ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$

- It reacts with bases (behaving as an acid):

$ZnO + 2NaOH \rightarrow Na_2ZnO_2 + H_2O$

Since it neutralises both acids and bases, it is called an amphoteric oxide.

Source: Metals and Non-metals, Chapter 3

Explanation

- The examiner wants **both reactions** (with acid and with base) to award full marks. Simply stating "reacts with both acids and bases" without equations may cost marks in a 2–3 mark question.
- The key term to use is **amphoteric** — defined as an oxide that behaves as both acidic and basic.
- Aluminium oxide (Al_2O_3) is the other standard example of an amphoteric oxide from the same chapter.

Q71. § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS **[5]**

Attempt option (A):

(i) Give reasons for the following : (I) Ionic compound have generally high melting points and boiling points. (II) Solder, an alloy of lead and tin, is used for welding electrical wires. (III) Carbon cannot reduce the oxides of Na or Mg. [3]

(ii) The reaction of compound 'X' with aluminium is used to join railway tracks : (I) Identify the compound 'X'. (II) Name the reaction. (III) Write the balanced chemical equation of the reaction of compound 'X' with aluminium. [2]

Previously asked in: 2026 31/5/1 Q29 ((A))

◆ **Metals and Non-metals** | Alloys – solder (lead-tin) used for welding electrical wires | Carbon cannot reduce oxides of highly reactive metals (Na, Mg) | Ionic compounds – high melting and boiling points | Thermite reaction – iron(III) oxide with aluminium to join railway tracks

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Model Answer

(i)

(I) Ionic compounds are held together by strong electrostatic forces of attraction between oppositely charged ions. A large amount of energy is needed to overcome these forces, so they have high melting and boiling points.

(II) Solder is an alloy of lead and tin with a **low melting point**. This allows it to melt easily and join electrical wires without damaging them due to excessive heat.

(III) Carbon can act as a reducing agent only at very high temperatures. Na and Mg are more reactive than carbon; they are higher in the reactivity series. Hence carbon cannot displace Na or Mg from their oxides — in fact, Na or Mg can reduce carbon dioxide.

(ii)

(I) Compound 'X' is **Iron(III) oxide (Fe_2O_3)**.

(II) The reaction is called the **Thermite reaction**.

(III) Balanced chemical equation:

$$Fe_2O_3(s) + 2Al(s) \rightarrow Al_2O_3(s) + 2Fe(l) + Heat$$

Source: Chemical Reactions and Equations, Chapter 1

Explanation

- For (i)(I): Always mention "strong electrostatic forces" — that phrase earns the mark.
- For (i)(II): The key point is **low melting point** of solder (not just that it's an alloy).
- For (i)(III): The logic is reactivity series — Na and Mg are above carbon, so carbon cannot reduce their oxides.
- For (ii): The thermite reaction (Fe_2O_3 + Al) is a standard 2-mark question. Examiners expect the correct name "Thermite reaction," correct identification of Fe_2O_3, and a fully balanced equation. Note that Fe is produced in liquid/molten form due to the large heat released — writing (l) is a good addition.

Q72. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? § 3.4 OCCURRENCE OF METALS **[1]**

Which one of the following metals does not react with cold water ?

(A) Sodium
(B) Potassium
(C) Calcium
(D) Magnesium

Previously asked in: 2026 31/4/1 Q21

◆ Metals and Non-metals | Reaction of Metals with Water

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Model Answer

(D) Magnesium

Magnesium does not react with cold water. It reacts only with hot water to form magnesium hydroxide and hydrogen gas.

Source: Chapter 3, Section 3.2.2

Explanation

The textbook clearly states: *"Magnesium does not react with cold water. It reacts with hot water..."* Sodium, potassium, and calcium all react with cold water (K and Na vigorously; Ca less violently). This is a common MCQ testing knowledge of the reactivity series — remember the order K > Na > Ca > Mg for reactions with water.

Q73. § Chapter Introduction § 3.1 PHYSICAL PROPERTIES § 3.4 OCCURRENCE OF METALS **[1]**

Alloys are homogeneous mixture of metal with a metal or non-metal. Which among the following alloys contain non-metal as one of its constituents ?

(A) Brass
(B) Bronze
(C) Amalgam
(D) Steel

Previously asked in: 2026 31/4/1 Q22

◆ Metals and Non-metals | Alloys and their Constituents

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Model Answer

(D) Steel

Steel is an alloy of iron (metal) and carbon (non-metal). Brass (copper + zinc) and Bronze (copper + tin) contain only metals, and amalgam contains mercury + another metal.

Explanation

Examiners expect you to recall the composition of common alloys. Steel = Fe + C (carbon is a non-metal) — this is the key fact. Brass = Cu + Zn; Bronze = Cu + Sn; Amalgam = Hg + another metal — all metal-only alloys.

Q74. § 3.2 CHEMICAL PROPERTIES OF METALS **[1]**

A metal 'X' is used in thermite process. When X is burnt in air it gives an amphoteric oxide 'Y'. 'X' and 'Y' are respectively :

(a) Fe and Fe_2O_3
(b) Al and Al_2O_3
(c) Fe and Fe_3O_4
(d) Al and Al_3O_4

Previously asked in: 2023 31/1/1 Q5

◆ **Metals and Non-metals** Thermite process and amphoteric oxides of metals

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Model Answer

(b) Al and Al_2O_3

Aluminium (Al) is used in the thermite process. When burnt in air, it forms aluminium oxide (Al_2O_3), which is an amphoteric oxide — it reacts with both acids and bases.

Explanation

Key facts to remember: (1) Thermite process uses aluminium powder mixed with iron oxide. (2) Al_2O_3 is the classic example of an amphoteric oxide in CBSE Class 10. Option (d) is wrong because Al_3O_4 does not exist; the correct formula is Al_2O_3.

Source: Chapter 3, Section 3.2.1

Q75. § 3.2 CHEMICAL PROPERTIES OF METALS **[4]**

> Three metal samples of magnesium, aluminium and iron were taken and rubbed with sand paper. These samples were then put separately in test tubes containing dilute hydrochloric acid. Thermometers were also suspended in each test tube so that their bulbs dipped in the acid. The rate of formation of bubbles was observed. The above activity was repeated with dilute nitric acid and the observations were recorded.

Answer the following questions :

(a) When activity was done with dilute hydrochloric acid, then in which one of the test tubes was the rate of formation of bubbles the fastest and the thermometer showed the highest temperature ? [1]

(b) Which metal did not react with dilute hydrochloric acid ? Give reason. [1]

(c) Answer either (i) or (ii): [2]

Previously asked in: 2024 31/4/1 Q37

◆ **Metals and Non-metals** | Reactivity Series of Metals | Reactivity of metals with dilute acids

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Model Answer

(a) The test tube containing **magnesium** showed the fastest rate of bubble formation and the highest temperature rise, because magnesium is the most reactive among the three metals.

(b) Iron did not react with dilute nitric acid (when the activity was repeated with it). However, with dilute HCl, all three metals react. *(Note: If the question refers to dilute HCl specifically, none of the three metals is completely unreactive with it; all three displace hydrogen.)*

> (Since sub-question (c) is incomplete — options (i) and (ii) are not provided — it cannot be answered.)

Source: Metals and Non-metals, Activity on reactivity of metals with dilute acids.

Explanation

- **For (a):** Reactivity order is Mg > Al > Fe. More reactive metals react faster and release more heat, so the thermometer reads highest in the Mg test tube.
- **For (b):** The passage says the activity was **also repeated with dilute nitric acid**. Iron (and other metals) generally do not react with **concentrated** HNO_3 due to passivation, but with *dilute* HCl all three do react. If the examiner intends dilute HNO_3, iron may be the expected answer due to passivation with nitric acid. Read the full question context carefully.
- **For (c):** The sub-options were missing from the question — always write what is given; do not attempt incomplete sub-questions.

Q76. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? § 3.5 CORROSION **[2]**

> One student was comparing the reactivity of different metals for his science project. He added iron filings in four test tubes A, B, C and D containing aqueous solutions of $ZnSO_4$, $CuSO_4$, $FeSO_4$ and $Al_2(SO_4)_3$.

Read the following passage and answer the questions that follow :

(i) In which of the test tubes will he observe the reaction to be the most vigorous and why ? [1]

(ii) Write a balanced equation for the reaction involved. [1]

Previously asked in: 2026 31/2/1 Q25

◆ **Metals and Non-metals** Displacement Reactions of Metals Reactivity Series of Metals

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Model Answer

(i) Test tube **B** (containing $CuSO_4$) will show the most vigorous reaction, because iron is more reactive than copper and can displace it from its salt solution. The difference in reactivity between Fe and Cu is the greatest among the four options.

(ii) Balanced equation:

$$Fe + CuSO_4 \rightarrow FeSO_4 + Cu$$

Explanation

- Iron cannot displace Zn or Al (both more reactive than Fe), and $FeSO_4$ already contains Fe, so no reaction occurs in A, C, D.
- Examiners expect you to justify the choice using the **reactivity series** — just naming the test tube without reason loses the mark.
- The balanced equation must show correct formulae and be properly balanced; state symbols are a bonus but not mandatory for full marks here.

Q77. § 3.2 CHEMICAL PROPERTIES OF METALS **[3]**

With the help of suitable chemical equations, list the two main differences between roasting and calcination. How is metal reduced from the product obtained after roasting/calcination of the ore ? Write the chemical equation for the reaction involved.

Previously asked in: 2023 31/2/1 Q28

◆ **Metals and Non-metals** | Reduction of metal oxides to metals (thermite/carbon/CO reduction) after roasting/calcination | Roasting vs Calcination – differences with chemical equations

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Model Answer

Differences between Roasting and Calcination:

	Roasting	Calcination
1.	Ore is heated in excess of air/oxygen	Ore is heated in limited/absence of air
2.	Applied to sulphide ores	Applied to carbonate/hydroxide ores

Chemical equations:

Roasting: $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

Calcination: $ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2$

Reduction of metal from oxide:

The metal oxide obtained is reduced using a suitable reducing agent like carbon (coke):

$$2ZnO + C \rightarrow 2Zn + CO_2$$

Source: Metals and Non-metals, Section 3.3 (Extraction of Metals)

Explanation

- Examiners expect **both differences clearly stated** — the key distinguishing points are (i) presence/absence of air and (ii) type of ore.
- One equation for each process is sufficient; ZnS/$ZnCO_3$ are standard textbook examples.
- For reduction, carbon reduction is the most common expected example. Some questions also accept thermite/aluminium reduction for highly reactive metal oxides, but carbon reduction suffices here.
- Do not mix up roasting (sulphides → oxides) with calcination (carbonates → oxides).

Q78. § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS § 3.4 OCCURRENCE OF METALS **[1]**

The metals obtained from their molten chlorides by the process of electrolytic reduction are :

(A) Gold and silver
(B) Calcium and magnesium
(C) Aluminium and silver
(D) Sodium and iron

Previously asked in: 2025 31/1/1 Q6

◆ Metals and Non-metals | Electrolytic Reduction of Molten Chlorides

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Model Answer

(B) Calcium and magnesium

Metals high in the reactivity series (K, Na, Ca, Mg, Al) are obtained by electrolytic reduction of their molten chlorides. Gold and silver occur in free state; iron is extracted by carbon reduction.

Source: Metals and Non-metals, Section 3.4.5

Explanation

The key fact from Section 3.4.5: sodium, magnesium, and calcium are obtained by electrolysis of their **molten chlorides**. Note that aluminium is extracted by electrolysis of aluminium **oxide** (not chloride), so option (C) is wrong. Iron uses carbon reduction; gold/silver occur native. Only option (B) lists two metals (Ca and Mg) correctly extracted from molten chlorides.

Q79. § 3.1 PHYSICAL PROPERTIES § 3.2 CHEMICAL PROPERTIES OF METALS § 3.5 CORROSION **[2]**

A light green coloured solution of sulphate salt of metal 'P' is taken in a beaker, a rod of another metal 'Q' is put in this solution as shown the following figures :
Identify the metals 'P' and 'Q' and write its chemical equation for the reaction that occurs. State the conclusion of this reaction in terms of reactivity series of metals.

Previously asked in: 2025 31/6/1 Q21

◆ **Metals and Non-metals** Chemical Equation for Iron and Copper Sulphate Reaction
Displacement Reactions – colour change in copper sulphate solution with iron Indicators of Chemical Reactions – Change in Colour
Reactivity Series and Displacement Reactions of Metals

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Model Answer

P = Iron (Fe); Q = Zinc (Zn)

The light green solution is $FeSO_4$ (ferrous sulphate), so metal P is **Iron (Fe)**. The solution turns colourless after the reaction, forming $ZnSO_4$, so metal Q is **Zinc (Zn)**.

Chemical equation:

$$Zn(s) + FeSO_4(aq) \rightarrow ZnSO_4(aq) + Fe(s)$$

Conclusion: Zinc is more reactive than iron. A more reactive metal displaces a less reactive metal from its salt solution.

Source: Chemical Reactions and Equations, Section 1.2.3 (Displacement Reaction)

Explanation

The key clues are: (1) light green colour of PSO_4 → $FeSO_4$ → P = Fe; (2) colourless product QSO_4 → $ZnSO_4$ → Q = Zn. The textbook directly gives the Zn + $CuSO_4$ example; this is the analogous reaction with $FeSO_4$. Examiners expect the balanced equation with state symbols and a one-line reactivity conclusion. Do not confuse P and Q — P is in solution, Q is the rod doing the displacing.

Q80. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.3 HOW DO METALS AND NON-METALS REACT? § 3.4 OCCURRENCE OF METALS **[1]**

Assertion (A) : The metals high up in the reactivity series cannot be obtained from their compounds by heating with carbon.

Reason (R) : Displacement reactions can also be used to obtain metal.

(A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A).
(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A).
(C) Assertion (A) is true, but Reason (R) is false.
(D) Assertion (A) is false, but Reason (R) is true.

Previously asked in: 2025 31/2/1 Q17

◆ **Metals and Non-metals** Displacement reactions for obtaining metals Reactivity series and extraction of metals

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Model Answer

(B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A). Metals high in the reactivity series are extracted by electrolytic reduction, not displacement.

Explanation

The Assertion is true — highly reactive metals (Na, Mg, Al, Ca, K) cannot be reduced by carbon because they have more affinity for oxygen than carbon. The Reason is also true — displacement reactions (e.g., thermite reaction) are used to obtain metals. However, displacement reactions explain how *mid-series* metals are extracted, not why *top-series* metals cannot be reduced by carbon. So R does not explain A → option **(B)**.

Q81. § 3.2 CHEMICAL PROPERTIES OF METALS § 3.5 CORROSION **[1]**

Assertion (A) : A piece of Zinc metal gets reddish brown coating when kept in copper sulphate solution for some time.
Reason (R) : Copper is more reactive metal than Zinc.

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 correct explanation of (A).
C (A) is true, but (R) is false.
D (A) is false, but (R) is true.

Previously asked in: 2024 31/3/1 Q17

◆ **Metals and Non-metals** Reactivity Series and Displacement Reactions

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Model Answer

Option (C): (A) is true, but (R) is false.

Assertion is true — Zinc displaces copper from copper sulphate solution, forming a reddish-brown copper coating: $\mathrm{Zn + CuSO_4 \rightarrow ZnSO_4 + Cu}$. But Reason is false — Zinc is **more** reactive than copper, not less.

Source: Chemical Reactions and Equations, Section 1.2.3; Metals and Non-metals, Section 3.2.5

Explanation

- The Assertion describes a displacement reaction — Zinc (being more reactive) displaces copper from $\mathrm{CuSO_4}$, depositing reddish-brown copper on the zinc piece. This is **true**.
- The Reason states copper is more reactive than zinc — this is **false**. The reactivity series clearly places Zn **above** Cu, meaning Zn is more reactive.
- Since A is true but R is false, the answer is **(C)**.
- Examiners expect you to state both the correct option and a brief justification referencing the reactivity series.

Q82. § 3.2 CHEMICAL PROPERTIES OF METALS | § 3.3 HOW DO METALS AND NON-METALS REACT? | § 3.5 CORROSION **[5]**

Attempt option (B):

(i) Write the balanced chemical equations when : (I) A mixture of Cu_2O and Cu_2S is heated. (II) ZnS is heated in the presence of oxygen. [2]

(ii) Give reasons for the following : (I) The wires carrying current in homes have a coating of PVC. (II) To make hot water tanks, copper is used and not steel. [2]

(iii) Show the formation of ionic compound CaO with electron dot structure. [Atomic number : Ca = 20, O = 8] [1]

Previously asked in: 2026 31/5/1 Q29 ((B))

◆ **Metals and Non-metals** | Electrical conductivity and insulating properties – PVC coating on wires | Electron dot structure and formation of ionic compounds – CaO | Extraction of metals – roasting and smelting reactions ($Cu_2O + Cu_2S$, $ZnS + O_2$) | Properties of metals – why copper is preferred over steel for hot water tanks

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Model Answer

(i)

(I) Heating a mixture of Cu_2O and Cu_2S:

$$2Cu_2O + Cu_2S \rightarrow 6Cu + SO_2 \uparrow$$

(II) ZnS heated in the presence of oxygen:

$$2ZnS + 3O_2 \xrightarrow{\Delta} 2ZnO + 2SO_2$$

(ii)

(I) PVC (polyvinyl chloride) is a poor conductor of electricity (insulator). It prevents electric shock to persons handling the wires.

(II) Copper does not react with hot water and does not corrode easily, making it suitable for hot water tanks. Steel (iron) reacts with hot water/steam and corrodes, contaminating water.

(iii) Formation of CaO:

Ca has 2 valence electrons; O needs 2 electrons to complete its octet.

$$Ca[\cdot\cdot] + [\cdot\cdot \underset{\cdot\cdot}{O} \cdot\cdot] \rightarrow Ca^{2+}[\ddot{\underset{\cdot\cdot\ \cdot\cdot}{O}}\ ]^{2-}$$

Ca donates 2 electrons to O. Ca becomes Ca^{2+} and O becomes O^{2-}, forming the ionic compound CaO.

Explanation

- **Q(i):** These are standard metallurgy reactions. The Cu_2O–Cu_2S reaction is the self-reduction used in copper extraction. ZnS roasting converts sulphide ore to oxide — a key step in metallurgy.
- **Q(ii):** For PVC coating, the keyword is "insulator/poor conductor → prevents electric shock." For copper tanks, focus on resistance to corrosion and non-reactivity with hot water. Avoid vague answers like "copper is better."

- **Q(iii):** Draw the electron dot (Lewis) structure clearly. Show electron transfer: Ca loses $2e^-$ → Ca^{2+}; O gains $2e^-$ → O^{2-}. Mention ionic bond formation. Even a rough diagram with dots/crosses earns the mark if the transfer is correctly shown.

Q83. § 3.4 OCCURRENCE OF METALS **[2]**

How is zinc extracted from its ore? Name the processes involved in the extraction and write chemical equations for the reactions that occur during these processes.

Previously asked in: 2025 31/4/1 Q22(B)

◆ **Metals and Non-metals** | Extraction of Zinc from its Ore | Reduction of Metal Oxides with Carbon (Coke) | Roasting of Zinc Ore (ZnS to ZnO)

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Model Answer

Zinc (as ZnS or $ZnCO_3$) is extracted by two processes — **roasting/calcination** (to convert ore to oxide) and **reduction** (to obtain metal).

Roasting:

$$2ZnS(s) + 3O_2(g) \xrightarrow{\Delta} 2ZnO(s) + 2SO_2(g)$$

Calcination:

$$ZnCO_3(s) \xrightarrow{\Delta} ZnO(s) + CO_2(g)$$

Reduction (ZnO reduced by carbon):

$$ZnO(s) + C(s) \rightarrow Zn(s) + CO(g)$$

Source: Chapter 3, Section 3.4.4

Explanation

- The question asks for **processes named + equations**, so name all three (roasting, calcination, reduction) and give all three equations.
- Zinc is a **medium-reactivity** metal, so carbon-reduction is used (not electrolysis).
- Examiners expect correct state symbols and balanced equations — these are easy marks, don't skip them.
- For 2 marks: naming the processes (½ + ½) + key equations (1 mark) is the likely split. Keep it concise but complete.

Q84. § 3.5 CORROSION **[1]**

A student notices that her silver jewellery turned dull and had a grey-black coating over it after wearing for a few months. What results in the change in colour of the silver metal ?

(A) The polish over the jewellery was removed after wearing for a few months.
(B) The jewellery comes in contact with air, moisture and acids and corrodes.
(C) Dust particles over the jewellery change its colour.
(D) Its colour changes due to rusting.

Previously asked in: 2026 31/2/1 Q23

◆ Metals and Non-metals | Corrosion of metals (tarnishing of silver) | Tarnishing of Silver

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Model Answer

(B) The jewellery comes in contact with air, moisture and acids and corrodes.

Silver reacts with sulphur in air to form a grey-black coating of silver sulphide — this is corrosion, not rusting.

Source: Chapter 1, Section 1.3.1 Corrosion; Chapter 3, Section 3.5 Corrosion

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Explanation

- Option **(D) is wrong** because rusting is specific to iron; silver does not rust.
- Option **(B)** is correct: corrosion of silver occurs when it contacts air (containing sulphur), moisture, and acids.
- Examiners expect you to distinguish between *rusting* (only iron/steel) and *corrosion* (general term for metals reacting with their environment).
- The textbook specifically states: *"Silver articles become black after some time when exposed to air — it reacts with sulphur in the air to form silver sulphide."* This is corrosion.

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