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CLASS X · SCIENCE (086) · CHEMISTRY · CBSE BOARD EXAMINATION 2027

CHAPTER 3

Metals and Non-metals

Chapter Practice Booklet · Questions only · Answers in the separate Answer Booklet

12 note blocks + 6 diagrams | 76 practice questions | 3 case studies | Board question index

INSIDE THIS BOOKLET

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STUDENT DETAILS

NAME _____

CLASS & SECTION _____

ROLL NO. _____

BOOKLET STARTED ON _____

CHAPTER TEST SCORE _____ / 20

1

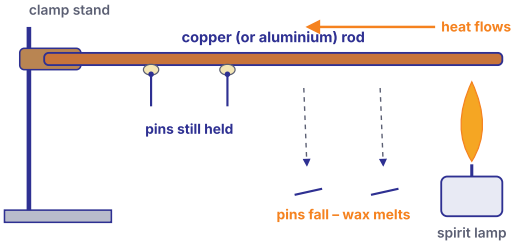
READ THIS FIRST

Chapter Notes

The whole chapter in short-note form: every definition, activity, diagram, formula and reason. Revise from here – you should not need the textbook again.

1 Physical properties of metals

- **Lustre:** a freshly cut or rubbed metal surface is shiny.
- **Hard** (most metals) and **solid** at room temperature, with high melting points.
- **Malleable:** can be beaten into thin sheets (gold and silver are the most malleable). **Ductile:** can be drawn into thin wires; gold is the most ductile – 1 g of gold can make a wire about 2 km long.
- **Good conductors of heat** (silver and copper are the best; **lead and mercury** are comparatively poor) and of **electricity**. Wires are coated with PVC or rubber because the metal conducts.
- **Sonorous:** they make a ringing sound when struck – used for school bells.



The pins nearest the flame fall first: heat travels along the metal

Exceptions: mercury is a **liquid**; sodium, potassium and lithium are **soft** enough to cut with a knife and have low density; gallium and caesium **melt on the palm**.

2 Non-metals and how they differ

- Non-metals are solids (C, S, I, P) or gases (O_2, N_2, H_2); **bromine is a liquid**. They are dull, **brittle** and poor conductors.
- **Exceptions:** iodine is **lustrous**; **graphite** (a form of carbon) **conducts** electricity; **diamond** (another form of carbon) is the **hardest natural substance** with a very high melting point.

Property	Metals	Non-metals
Hammering	Flatten (malleable)	Break (brittle)
Conduction	Good	Poor (not graphite)
Ions formed	Lose electrons → **+ ions**	Gain electrons → **– ions**
Oxides	**Basic** (some amphoteric)	**Acidic** or neutral

- **Test the oxide:** burnt magnesium gives MgO, which dissolves to give $Mg(OH)_2$ – red litmus turns **blue**. Burnt sulphur gives SO_2, which dissolves to give sulphurous acid – blue litmus turns **red**.

$$SO_2 + H_2O \longrightarrow H_2SO_3$$

Uses of non-metals: oxygen for breathing, nitrogen and phosphorus in fertilisers, chlorine to purify water, iodine solution as an antiseptic.

3 Metals with oxygen

- **Metal + oxygen → metal oxide**. Copper turns black on heating; aluminium forms its oxide:

$$2\,Cu + O_2 \longrightarrow 2\,CuO$$

$$4\,Al + 3\,O_2 \longrightarrow 2\,Al_2O_3$$

- Metal oxides are **basic**. **Amphoteric oxides** such as Al_2O_3 and ZnO react with **both acids and bases** to give salt and water:

$$Al_2O_3 + 6\,HCl \longrightarrow 2\,AlCl_3 + 3\,H_2O$$

$$Al_2O_3 + 2\,NaOH \longrightarrow 2\,NaAlO_2 + H_2O$$

$NaAlO_2$ is sodium aluminate.

- Oxides that dissolve in water give **alkalis**: $Na_2O + H_2O \longrightarrow 2\,NaOH$
- **K and Na** catch fire in open air, so they are **stored under kerosene**. Mg, Al, Zn and Pb get a thin **protective oxide layer**. Mg burns with a **dazzling white flame**; iron burns only as filings sprinkled in a flame; copper does not burn but gets a black CuO coat; **silver and gold do not react** even at high temperature.
- **Anodising:** aluminium is made the **anode** in electrolysis with dilute H_2SO_4; the oxygen thickens the oxide layer, which resists corrosion and can be dyed.

4 Metals with water

- **Metal + water → metal oxide + hydrogen**; a soluble oxide then gives the hydroxide.

$$2\,Na + 2\,H_2O \longrightarrow 2\,NaOH + H_2 + \text{heat}$$

- **K and Na** react violently with **cold** water; so much heat is given out that the hydrogen catches fire.

$$Ca + 2\,H_2O \longrightarrow Ca(OH)_2 + H_2$$

- **Calcium** reacts less violently – the hydrogen does not catch fire – and the metal **floats** because hydrogen bubbles stick to it. **Magnesium** reacts with **hot** water and also floats.
- **Al, Zn and Fe** react only with **steam**:

$$2\,Al + 3\,H_2O \longrightarrow Al_2O_3 + 3\,H_2$$

$$3\,Fe + 4\,H_2O \longrightarrow Fe_3O_4 + 4\,H_2$$

- **Pb, Cu, Ag and Au** do not react with water at all.

5 Metals with dilute acids

- **Metal + dilute acid → salt + hydrogen** (for metals above hydrogen in the series).

$$Mg + 2\,HCl \longrightarrow MgCl_2 + H_2$$

$$2\,Al + 6\,HCl \longrightarrow 2\,AlCl_3 + 3\,H_2$$

$$Fe + 2\,HCl \longrightarrow FeCl_2 + H_2$$

- Fizzing is fastest with **Mg**, then Al, Zn and Fe. **Copper** shows no reaction.
- **Nitric acid:** hydrogen is **not** given off, because HNO_3 is a strong **oxidising agent**: it oxidises the hydrogen to water and is itself reduced to nitrogen oxides. Only **Mg and Mn** give hydrogen with **very dilute** HNO_3.

> **Aqua regia** (‘royal water’): a freshly made mixture of **concentrated HCl and concentrated** HNO_3 **in the ratio 3 : 1**. This fuming liquid dissolves **gold and platinum**, which neither acid can dissolve alone.

6 Reactivity series and displacement

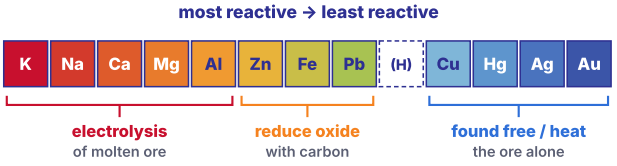
- A **more reactive** metal displaces a less reactive metal from the solution of its salt:

$$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu$$

- Blue solution turns light green; a brown copper coat forms on the iron.

$$Cu + 2\,AgNO_3 \longrightarrow Cu(NO_3)_2 + 2\,Ag$$

- The colourless solution turns blue; shiny silver forms on the copper. But copper placed in iron sulphate solution shows **no change** – copper is less reactive than iron.
- The **reactivity series** lists metals in order of **decreasing** activity.



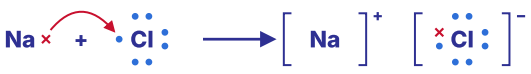
Water: K, Na, Ca (cold) · Mg (hot) · Al, Zn, Fe (steam only)
Dilute acids: metals above H give H_2; Cu, Hg, Ag, Au do not

The reactivity series and how each group is extracted

7 How metals and non-metals combine

- **Noble gases** (He, Ne, Ar) have a completely filled outer shell (8 electrons; 2 for helium) and hardly react.
- A **metal loses** its outer electrons to become a positive ion (**cation**); a **non-metal gains** electrons to become a negative ion (**anion**). Both then have a noble-gas configuration.
- The ions are held by strong **electrostatic attraction**. Compounds formed by this **transfer of electrons** from a metal to a non-metal are **ionic** or **electrovalent** compounds.

Sodium chloride — Na 2,8,1 → Na^+ 2,8 · Cl 2,8,7 → Cl^- 2,8,8



ions held by strong electrostatic force

Magnesium chloride — Mg 2,8,2 → Mg^{2+} 2,8 · each Cl → Cl^-



× = electron of the metal · • = electron of the non-metal

Formation of NaCl and $MgCl_2$ by transfer of electrons

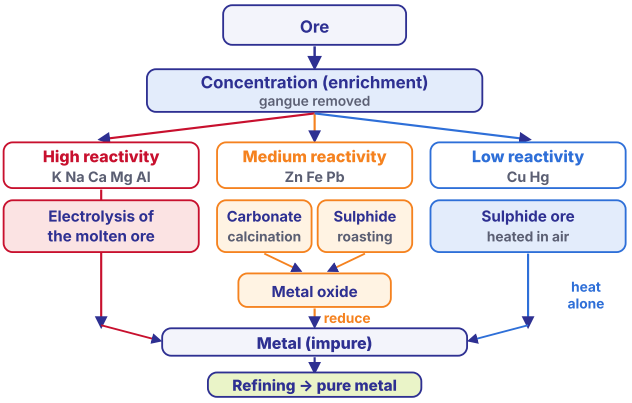
8 Properties of ionic compounds

- **Solid and hard** because of the strong attraction between ions; **brittle** – they break into pieces when pressed.
- **High melting and boiling points**: a lot of energy is needed to overcome the strong attraction between ions.
- **Soluble in water**, but **insoluble** in kerosene and petrol.
- **Conduct electricity** when **molten** or **dissolved in water** (the ions can move), but **not as solids** (the ions are held in a rigid structure).

Compound	Melting point (K)	Boiling point (K)
NaCl	1074	1686
LiCl	887	1600
$CaCl_2$	1045	1900
CaO	2850	3120
$MgCl_2$	981	1685

9 Occurrence of metals; steps of extraction

- The **earth's crust** is the main source of metals; sea water holds soluble salts such as NaCl and $MgCl_2$.
- **Mineral:** an element or compound that occurs naturally in the crust. **Ore:** a mineral from which a metal can be extracted **profitably**. **Gangue:** the soil, sand and other impurities mixed with the ore; it is removed first (**enrichment**).
- Metals at the **bottom** of the series (Au, Ag, Pt, Cu) are found **free**; Cu and Ag also as sulphides and oxides. **Middle** metals (Zn, Fe, Pb) occur as oxides, sulphides or carbonates. Metals at the **top** are **never found free**. Many ores are oxides because oxygen is plentiful and reactive.



Steps in the extraction of metals

10 Extracting metals low and middle in the series

- **Low reactivity – heat alone.** Cinnabar (HgS) gives mercury:

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

$$2\,HgO \xrightarrow{heat} 2\,Hg + O_2$$

- Copper from Cu_2S: part of the ore becomes the oxide, which then reacts with the rest of the sulphide:

$$2\,Cu_2S + 3\,O_2 \xrightarrow{heat} 2\,Cu_2O + 2\,SO_2$$

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

- **Middle reactivity.** It is easier to get a metal from its **oxide**, so the ore is first changed to the oxide. **Roasting** = heating a **sulphide** ore strongly in **excess air**; **calcination** = heating a **carbonate** ore strongly in **limited air**.

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

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

- The oxide is **reduced** with carbon (coke): $ZnO + C \longrightarrow Zn + CO$
- A more reactive metal such as Al can also reduce an oxide. The **thermit reaction** gives so much heat that the iron comes out **molten** – used to join railway tracks and cracked machine parts:

$$Fe_2O_3 + 2\,Al \longrightarrow 2\,Fe + Al_2O_3 + heat$$

$$3\,MnO_2 + 4\,Al \longrightarrow 3\,Mn + 2\,Al_2O_3 + heat$$

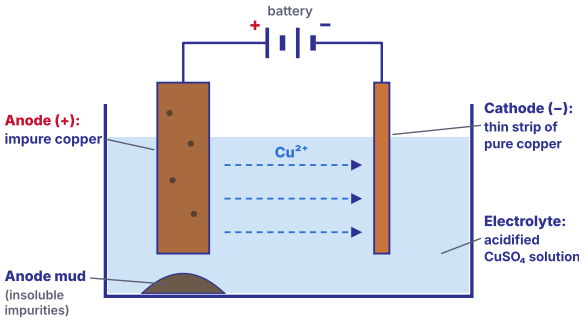
11 Highly reactive metals; refining

- Na, Mg, Ca and Al have a **greater affinity for oxygen than carbon**, so carbon cannot reduce their oxides. They are obtained by **electrolytic reduction** of their **molten chlorides** (aluminium from its molten oxide). The metal forms at the **cathode**, chlorine at the **anode**:

$$Na^+ + e^- \longrightarrow Na$$

$$2\,Cl^- \longrightarrow Cl_2 + 2\,e^-$$

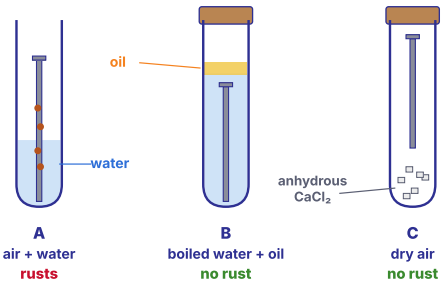
- **Electrolytic refining** (Cu, Zn, Sn, Ni, Ag, Au): **anode** = impure metal; **cathode** = thin strip of pure metal; **electrolyte** = a solution of a salt of the metal (acidified copper sulphate for copper).
- On passing current, metal from the anode dissolves and the same amount of **pure metal deposits on the cathode**. Soluble impurities stay in solution; insoluble ones settle below the anode as **anode mud**.



Electrolytic refining of copper

12 Corrosion, its prevention, and alloys

- **Corrosion:** silver turns **black** (silver sulphide, from sulphur in air); copper gets a **green** coat (basic copper carbonate, from moist CO_2); iron gets a brown, flaky coat of **rust**.



Iron rusts only when both air and water are present

B: boiling removes dissolved air and the oil keeps air out. C: anhydrous calcium chloride absorbs moisture.

- **Prevention:** painting, oiling, greasing, **galvanising** (a zinc coat – the iron stays protected even if the coat is broken), chrome plating, anodising, making alloys.
- **Alloy:** a homogeneous mixture of two or more metals, or of a metal and a non-metal. Iron with about **0.05% carbon** becomes hard and strong. **Stainless steel** = iron + nickel + chromium (hard, does not rust). **Brass** = Cu + Zn; **bronze** = Cu + Sn; **solder** = Pb + Sn (low melting point, used to join electrical wires). An alloy with mercury is an **amalgam**.
- An alloy has a **lower melting point** and **lower electrical conductivity** than the pure metals. Pure (24-carat) gold is too soft; **22-carat** gold has 22 parts gold and 2 parts copper or silver.

Explain why – quick answers

Common 1- and 2-mark reasons

Sodium is kept under kerosene – it reacts so vigorously with air and moisture that it catches fire.

Calcium floats on water – bubbles of hydrogen stick to its surface.

Nitric acid gives no hydrogen with most metals – it oxidises the hydrogen to water.

Ionic compounds have high melting points – strong forces between ions need much energy to break.

Solid NaCl does not conduct, but molten NaCl does – the ions can move only when it is molten or dissolved.

Aluminium resists corrosion – a thin layer of aluminium oxide protects it.

Copper vessels turn green – a coat of basic copper carbonate forms with moist CO_2.

Carbon cannot reduce sodium or aluminium oxide – these metals hold oxygen more strongly than carbon.

Ores are changed to oxides before reduction – a metal is easier to obtain from its oxide.

Thermit welding joins railway tracks – the reaction is so exothermic that iron forms in the molten state.

Solder is used for electrical joints – its melting point is low.

A scratched galvanised bucket does not rust – zinc is more reactive, so it reacts in place of the iron.

Exam snapshot

What the board asks, and how to prepare

SYLLABUS 2026–27

- Properties of metals and non-metals; reactivity series; formation and properties of ionic compounds; basic metallurgical processes; corrosion and its prevention.

BOARD WEIGHTAGE

25 / 80

Chemistry = 25 marks (Section B). Chapters 1–4 share these marks. This chapter got 8 marks in the 2026 paper (two MCQs, a 2-mark question on amphoteric oxides and the 4-mark case on extraction) and about 5 in the 2026–27 sample paper (an MCQ on aluminium and a 4-mark case on heat conduction). A 4-mark case on alloys appeared in 2025.

MOST ASKED IN BOARD AND SAMPLE PAPERS, 2025–2027 (5 PAPERS CHECKED)

How often	Question type	Marks	Papers
★★★	Physical properties of metals and non-metals; exceptions	1–4	3 of 5
★★☆	Metals with oxygen, water and acids; amphoteric oxides	1–2	2 of 5
★☆☆	Reactivity series and displacement reactions	2	1 of 5
★★☆	Ionic compounds: transfer of electrons, properties	1–3	2 of 5
★★★	Extraction of metals: roasting, calcination, reduction, electrolysis, refining	3–4	3 of 5
★★★	Corrosion, its prevention, and alloys	1–4	3 of 5

MISTAKES THAT COST MARKS

- Writing that all metals are solid – **mercury is a liquid**.
- Showing hydrogen given off with **nitric acid** – it oxidises the hydrogen to water.
- Showing **shared** electrons in NaCl or $MgCl_2$ – ionic bonds form by **transfer** of electrons.
- Mixing up **roasting** (sulphide ore, excess air) and **calcination** (carbonate ore, limited air).
- Putting the impure copper at the cathode – in refining, **impure metal is the anode**.
- Saying a less reactive metal displaces a more reactive one – copper does **not** displace iron.

HOW TO USE THIS BOOKLET

1. **Day 1:** Read the notes and the key tables; then Part A (NCERT).
2. **Day 2:** Part B (Exemplar) and Part C (board pattern). Do every MUST DO question first.
3. **Day 3:** Part D (case studies) and the real board questions listed in Part E.
4. **Mon 11 Jan (zero period): Chemistry chapter test – 20 marks, 40 minutes.**
5. Check every answer in the **Answer Booklet**. Write each mistake on the My Mistakes page (Part F).

PART A · NCERT PRACTICE

A NCERT Practice

The ideas of every NCERT activity, in-text question and exercise, asked in new words. Finish every question.

Physical properties

A1. Name a metal that: MUST DO [2]

(i) is a liquid at room temperature
(ii) is soft enough to cut with a knife
(iii) is the best conductor of heat
(iv) is a comparatively poor conductor of heat

A2. What do the terms malleable and ductile mean? Name the metal that is the most ductile. [2]

A3. Why are copper and aluminium used to make cooking vessels, and why are electric wires covered with PVC or rubber? [2]

A4. Name a non-metal that: [2]

(i) is a liquid at room temperature
(ii) is lustrous
(iii) is the hardest natural substance
(iv) conducts electricity

A5. You have a hammer, a battery, a bulb, a switch and connecting wires. How will you use them to tell samples of metals from non-metals? MUST DO [3]

Chemical properties of metals

A6. Why are sodium and potassium stored under kerosene? MUST DO [2]

A7. Write balanced equations for the reactions of: MUST DO [3]

(i) iron with steam (ii) calcium with water (iii) potassium with water

A8. What are amphoteric oxides? Give two examples and write one equation to show this nature. [3]
MUST DO

A9. Name two metals that give hydrogen with dilute acids and two that do not. [2]

A10. Why is hydrogen not usually given off when a metal reacts with nitric acid? Name the metals that are exceptions. [2]

A11. What is aqua regia? Why is it special? [2]

Reactivity series

A12. Four metals J, K, L and M were put in salt solutions with these results: J displaced iron from iron(II) sulphate but not zinc from zinc sulphate; K did not react with copper sulphate but displaced silver from silver nitrate; L displaced zinc from zinc sulphate; M did not react even with silver nitrate. MUST DO [3]

(i) Which is the most reactive?
(ii) What will happen if K is put in copper sulphate solution?
(iii) Arrange the four metals in decreasing order of reactivity.

A13. What will you see when zinc granules are added to iron(II) sulphate solution? Write the equation. [2]

A14. An iron knife is dipped in blue copper sulphate solution. What change is seen and why? [2] MUST DO

A15. Oxides of zinc, magnesium and copper are each heated with the metals zinc, magnesium and copper. In which cases does displacement take place? [2]

Ionic compounds

A16. (a) Write the electron-dot structures of sodium, oxygen and magnesium. (b) Show the formation of Na_2O and MgO by transfer of electrons. (c) Name the ions present in these compounds. [5] MUST DO

A17. Why do ionic compounds have high melting points? [1]

A18. When do ionic compounds conduct electricity, and why not in the solid state? [2] MUST DO

Occurrence and extraction

A19. Define (i) mineral (ii) ore (iii) gangue. [3] MUST DO

A20. Name two metals that are found in the free state in nature, and explain why they occur free. [2]

A21. Explain roasting and calcination with one equation each. [4] MUST DO

A22. Which process is used to get a metal from its oxide? Give an example with an equation. [2]

A23. Describe the electrolytic refining of copper with a labelled diagram. [5] MUST DO

Corrosion and alloys

A24. What are the conditions needed for iron to rust? Give two ways of preventing it. [2] MUST DO

A25. Explain why silver articles become black and copper vessels become green on long exposure to air. [2]

A26. What is an alloy? Name the constituents of brass, bronze and solder. [2]

A27. Why is pure gold not used for making jewellery? What is meant by 22-carat gold? [2]

B

PART B · EXEMPLAR PRACTICE

Exemplar Practice

Exemplar-style questions, one step harder. Give a reason with every short answer.

Multiple choice

1 mark each

B1. Which metal is the most ductile? [1]

(a) Silver (b) Gold (c) Copper (d) Aluminium

B2. Element X is soft, can be cut with a knife and reacts violently with cold water. X is most likely: [1]

(a) sodium (b) magnesium (c) aluminium (d) iron

B3. Which of these oxides is amphoteric? [1]

(a) Na_2O (b) MgO (c) ZnO (d) CO_2

B4. Which metal does not react with dilute hydrochloric acid? [1]

(a) Zinc (b) Iron (c) Copper (d) Magnesium

B5. An element has the electronic configuration 2, 8, 2. The ion it forms is: [1]

(a) X^{+} (b) X^{2+} (c) X^{-} (d) X^{2-}

B6. Aqua regia contains concentrated HCl and concentrated HNO_3 in the ratio: [1]

(a) 1 : 3 (b) 3 : 1 (c) 2 : 1 (d) 1 : 1

B7. Which pair will react? [1]

(a) NaCl solution + copper (b) $MgCl_2$ solution + aluminium

(c) $FeSO_4$ solution + silver (d) $AgNO_3$ solution + copper

B8. Ionic compounds generally (i) have high melting points (ii) dissolve in kerosene (iii) conduct when molten (iv) are hard and brittle. The correct ones are: [1]

(a) (i) and (ii) (b) (i), (iii) and (iv)

(c) (ii) and (iii) (d) all four

B9. The thermit reaction is used to: [1]

(a) make steel (b) join railway tracks

(c) extract sodium (d) refine copper

B10. Which alloy is made of lead and tin? [1]

(a) Brass (b) Bronze (c) Solder (d) Stainless steel

Short answer

2–3 marks

B11. Element A burns in air with a dazzling white flame. The white ash dissolves in water and the solution turns red litmus blue. Identify A and write the equations for both steps. MUST DO [3]

B12. Why does calcium start floating when it reacts with water? Why does the hydrogen not catch fire, as it does with sodium? [2]

B13. Metal X occurs as the sulphide XS. Heating XS in air gives XO, which is heated with coke to give X. X is used to coat iron to prevent rusting. Identify X and write the two equations. MUST DO [3]

B14. Why cannot sodium be obtained by heating its oxide with carbon? How is it obtained? Write the reactions at the two electrodes. MUST DO [3]

B15. Element P has the configuration 2, 8, 1 and Q has 2, 8, 7. (a) What type of bond forms between them? (b) Write the formula of the compound. (c) Will it conduct electricity in the solid state? [3]

B16. Iron sheets are given a thin coat of zinc. Name this process. Why is the iron protected even when the coat gets scratched? [2]

C

PART C · BOARD PATTERN

Board Pattern Practice

Question types from the 2025 and 2026 board papers and the CBSE sample papers. ★★★ = asked in 3 or more of the 5 papers checked · ★★ = 2 papers · ★ = 1 paper.

ASSERTION–REASON: HOW TO ANSWER

(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.

Physical properties

★★★ 3 of 5 papers · 1–4 marks

C1. Which of these metals is a comparatively poor conductor of heat? [1]

(a) Copper (b) Silver (c) Lead (d) Aluminium

C2. The property that lets a metal be drawn into wires is: [1]

(a) malleability (b) ductility (c) sonority (d) lustre

C3. ASSERTION–REASON [1]

Assertion (A): Graphite is used to make electrodes.

Reason (R): Graphite is a non-metal that conducts electricity.

C4. Describe an activity to show that metals are good conductors of heat. MUST DO [3]

C5. Give reasons: (a) gold and silver are used for jewellery (b) aluminium foil is used to wrap food. [2]

Reactions with oxygen, water and acids

★★☆ 2 of 5 papers · 1–2 marks

C6. A metal reacts with cold water less violently than sodium; the hydrogen does not catch fire and the metal starts floating. The metal is: [1]

(a) potassium (b) calcium
(c) magnesium (d) iron

C7. Which oxide reacts with both hydrochloric acid and sodium hydroxide? [1]

(a) MgO (b) Na_2O (c) Al_2O_3 (d) CO_2

C8. ASSERTION–REASON [1]

Assertion (A): Most metals do not give hydrogen gas with nitric acid.

Reason (R): Nitric acid is a strong oxidising agent that oxidises the hydrogen to water.

C9. What are amphoteric oxides? Classify Al_2O_3, K_2O and SO_2 as acidic, basic or amphoteric. [2]
MUST DO

C10. Write balanced equations for: (a) aluminium oxide with hydrochloric acid (b) aluminium oxide with sodium hydroxide (c) sodium with water. MUST DO [3]

C11. Equal strips of Mg, Al, Zn, Fe and Cu are put in five test tubes of dilute HCl. (a) Arrange them by the rate of fizzing. (b) Why is there no change with copper? (c) Write the equation for magnesium. [3]

Reactivity series and displacement

★☆☆ 1 of 5 papers · 2 marks

C12. A copper wire is placed in silver nitrate solution. The colour of the solution changes from: [1]

(a) colourless to blue (b) blue to colourless
(c) green to blue (d) it does not change

C13. Which of these will not take place? [1]

(a) $Zn + CuSO_4$ (b) $Fe + CuSO_4$
(c) $Cu + FeSO_4$ (d) $Mg + ZnSO_4$

C14. Metal P displaces metal Q from the solution of Q's sulphate, but Q cannot displace P. (a) Which is more reactive? (b) If P is zinc and the solution of Q's sulphate is blue, name Q and write the equation. MUST DO [2]

C15. What do you observe, and why, when (a) a copper strip is kept in iron(II) sulphate solution (b) a zinc strip is kept in copper sulphate solution? [2]

Ionic compounds

★★☆ 2 of 5 papers · 1–3 marks

C16. Elements with which pair of configurations will form an ionic compound? [1]

(a) 2,8,1 and 2,8,7 (b) 2,4 and 2,6
(c) 2,8,8 and 2,8 (d) 2 and 2,8,8

C17. An ionic compound conducts electricity: [1]

(a) as a solid (b) when molten
(c) when mixed with kerosene (d) never

C18. Show the formation of magnesium chloride by the transfer of electrons. Name the ions present. MUST DO [3]

C19. Why are ionic compounds soluble in water but not in kerosene? Why do they have high boiling points? [2]

C20. Element X has configuration 2, 8, 2 and Y has 2, 6. (a) Which is a metal? (b) What ion does each form? (c) Write the formula of the compound and name the type of bond. [3]

Extraction and refining of metals

★★★ 3 of 5 papers · 3–4 marks

C21. Calcination means: [1]

(a) heating a sulphide ore in excess air (b) heating a carbonate ore in limited air
(c) electrolysis of a molten ore (d) reduction of an oxide with aluminium

C22. In the electrolytic refining of copper, the cathode is: [1]

(a) impure copper (b) a thin strip of pure copper
(c) a graphite rod (d) an iron rod

C23. ASSERTION–REASON [1]

Assertion (A): Aluminium is obtained by electrolysis of its oxide and not by heating the oxide with carbon.

Reason (R): Aluminium has a greater affinity for oxygen than carbon.

C24. How is mercury obtained from cinnabar? Write the equations. Why can such metals be obtained by heating alone? MUST DO [3]

C25. Copper is obtained from Cu_2S by heating in air. Write the two equations and say why no reducing agent like carbon is needed. MUST DO [3]

C26. Write the equation for the thermit reaction. Name the reducing agent and give one use of the reaction. [3]

Corrosion and alloys

★★★ 3 of 5 papers · 1–4 marks

C27. Stainless steel is made by mixing iron with: [1]

(a) carbon and zinc (b) nickel and chromium
(c) copper and tin (d) lead and tin

C28. Aluminium utensils do not corrode easily because: [1]

(a) aluminium is unreactive (b) a thin oxide layer protects them
(c) aluminium is an alloy (d) aluminium is below hydrogen

C29. Iron nails are kept in three test tubes: A – tap water, open to air; B – boiled distilled water with a layer of oil; C – dry air over anhydrous calcium chloride. In which tube do the nails rust? Explain each result. MUST DO [3]

C30. Pure iron is soft. How is it made hard and strong? Why is solder used to join electrical wires? [2]

Long answer

5 marks

C31. (a) Write equations for: (i) sodium with water (ii) iron with steam (iii) zinc with dilute hydrochloric acid. (b) Why does copper not react with dilute acids? (c) What is aqua regia? MUST DO [5]

C32. (a) Give the steps, with equations, to obtain zinc from zinc sulphide ore. (b) Explain how the zinc obtained is refined. MUST DO [5]

C33. (a) Show the formation of calcium oxide (Ca: 2,8,8,2; O: 2,6) by transfer of electrons. (b) State three properties of ionic compounds with a reason for each. [5]

PART D · SECTION B CASE STYLE

D Case-Based Questions

Each case carries 4 marks (1 + 1 + 2), as in the case-based questions of the board paper.

D1. Case Study · The Hot Rods [4]

In the science lab, students took four rods of the same length and thickness – copper, aluminium, iron and glass. They fixed a pin with wax at one end of each rod and heated the other end with identical spirit lamps. The pin on the copper rod fell after 2 minutes, on aluminium after 3 minutes and on iron after 6 minutes. The pin on the glass rod had not fallen even after 15 minutes.

(i) Which material conducts heat best? [1]

(ii) Why did the pin on the glass rod not fall? [1]

(iii) Name the metal that is the best conductor of heat and two metals that are comparatively poor conductors of heat. [2]

OR

(iii) Why are cooking pans made of copper or aluminium, while their handles are made of plastic or wood? [2]

D2. Case Study · From Ore to Metal [4]

A mining company found two ores of the same metal. Ore X fizzed with dilute hydrochloric acid and gave a gas that turned lime water milky. Ore Y, when heated in air, gave a gas with the choking smell of burning sulphur. Both ores were first changed into the metal oxide, which was then heated with coke. The metal is used to galvanise iron.

(i) Name the process used to change ore X into the oxide. [1]

(ii) Name the gas given off when ore Y is heated in air. [1]

(iii) Write the equations for the roasting of the sulphide ore and the reduction of the oxide. [2]

OR

(iii) Why can aluminium not be obtained in this way? How is it obtained? [2]

D3. Case Study · The Old House [4]

Riya visited her grandparents' old house. The iron gate had brown flakes on it, the copper water pot had a green coat, and a silver plate had turned black. The brass door handles still shone, a galvanised iron bucket was in good shape even though it had scratches, and an electrician was joining wires with solder.

(i) What two conditions caused the iron gate to rust? [1]

(ii) What is the green coat on the copper pot? [1]

(iii) Name the metals in brass and in solder. Why is solder used for joining wires? [2]

OR

(iii) What is galvanisation? Why did the scratched bucket not rust? [2]

PART E · REAL BOARD QUESTIONS

E Board PYQ Index

Real questions from recent Science board papers and CBSE sample papers, by type. Open the official paper and solve the listed questions.

Frequency	Question type	Marks	Where asked (year: paper code, question number)	Practise here
★★★	**Physical properties of metals and non-metals; exceptions**	1–4	**2026:** 31/1/1 Q21 (metal that is a poor conductor) · **2025:** Delhi Set 1 Q3 (ductility), Q28 (activity: metals conduct heat) · **SQP 2026–27:** Q28 (case: heat conduction in metal rods)	A1–A5, B1–B2, C1–C5, D1
★★☆	**Metals with oxygen, water and acids; amphoteric oxides**	1–2	**2026:** 31/1/1 Q23 (metal that floats when it reacts with water), Q25 (amphoteric oxides; classify oxides) · **SQP 2024–25:** Q2 (match metals and properties, amphoteric oxide), Q17 (A–R: metal and acid give hydrogen)	A6–A11, B3–B4, B6, B11–B12, C6–C11, C31
★☆☆	**Reactivity series and displacement reactions**	2	**2025:** OD Set 1 Q21 (metals P and Q, displacement)	A12–A15, B7, C12–C15
★★☆	**Ionic compounds: transfer of electrons, properties**	1–3	**2025:** Delhi Set 1 Q22 (electron transfer in $MgCl_2$) · **SQP 2024–25:** Q6 (configurations of a metal and a non-metal)	A16–A18, B5, B8, B15, C16–C20, C33
★★★	**Extraction of metals: roasting, calcination, reduction, electrolysis, refining**	3–4	**2026:** 31/1/1 Q28 (case: ores to oxides, Al as reducing agent, copper from Cu_2S OR reactive metals and carbon) · **2025:** Delhi Set 1 Q22 OR (extraction of zinc) · **SQP 2024–25:** Q27 (Al_2O_3 and MgO; copper from Cu_2S)	A19–A23, B9, B13–B14, C21–C26, C32, D2
★★★	**Corrosion, its prevention, and alloys**	1–4	**2026:** 31/1/1 Q28 OR (solder) · **2025:** OD Set 1 Q37 (case: solder, brass, stainless steel) · **SQP 2026–27:** Q23 (why aluminium resists corrosion)	A24–A27, B10, B16, C27–C30, D3

PAPERS CHECKED (5)

- 2026 board paper 31/1/1 (Set 1) – first paper with separate Biology, Chemistry and Physics sections
- 2025 board paper, Outside Delhi Set 1
- 2025 board paper, Delhi Set 1
- CBSE Sample Question Paper 2024–25
- CBSE Sample Question Paper 2026–27 (the pattern for your exam)

★★★ = asked in 3 or more of the 5 papers checked · ★★ = 2 papers · ★ = 1 paper. Codes: OD = Outside Delhi. Each paper was read question by question; questions from the 2026–27 Sample Paper after Q20 were checked from a summary of the paper. Download the official papers from cbse.gov.in → Previous Year Question Papers and cbseacademic.nic.in → Sample Question Papers, and solve the exact questions listed.

F

PART F · YOUR RECORD

My Mistakes

Write down each mistake from this chapter, including the chapter test.

Every wrong answer is a free lesson. Write it here, find the rule you missed, and redo the question after three days. Bring this page to class before the chapter test.

Date	Part & Q No.	What went wrong	Correct rule or method	Redone ✓