

CBSE CLASS X
Science (086)

QUESTION PAPER

*AI-generated question paper***Code: KTEOTB****Questions: 31****Maximum Marks: 83****Generated: 2026-06-25 17:42****SELECTIONS USED**

Subject	Science
Lessons	3 Metals and Non-metals
Level of understanding	Thorough understanding
Question selection	Curated chapter coverage (~5 questions per section + 8 synthesis)
Model	claude-sonnet-4-6

Composition — Difficulty: 1 straightforward · 18 medium · 12 deep | Types: 24 Short · 5 MCQ · 2 Long

Q1. deep thorough-understanding § Chapter Introduction **[3]**

Graphite, a form of carbon, conducts electricity like a metal, whereas sulfur — also a non-metal — is a brittle solid that does not conduct electricity at all. Yet both are classified as non-metals. (i) What does this suggest about using physical properties alone to classify elements as metals or non-metals? (ii) Which category of properties provides a more reliable basis for this classification? Justify your answer with one example.

◆ Metals and Non-metals**Q2.** deep thorough-understanding § 3.1 PHYSICAL PROPERTIES **[3]**

Iodine is a non-metal, yet it has a shiny surface, and graphite is a non-metal that conducts electricity. What do these two exceptions tell us about the reliability of physical properties alone for classifying elements as metals or non-metals?

◆ Metals and Non-metals**Q3.** medium thorough-understanding § 3.1 PHYSICAL PROPERTIES **[2]**

A metal worker shapes copper into various forms for industrial use — flattening it into thin sheets and stretching it into long, thin wires. Name the two physical properties of copper being utilised in each case and explain how each property makes the respective process possible.

◆ Metals and Non-metals**Q4.** medium thorough-understanding § 3.1 PHYSICAL PROPERTIES **[3]**

Electric wires used in homes are made of copper or aluminium but are always covered with PVC or a rubber-like coating. Why is the metal core chosen for the inner part, and why must the outer covering be made of a non-metal material?

◆ Metals and Non-metals

Q5. medium thorough-understanding § 3.1 PHYSICAL PROPERTIES [1]

Which of the following statements about the physical properties of metals is INCORRECT?

- (A) Mercury is the only metal that exists as a liquid at room temperature.
- (B) Alkali metals such as sodium and potassium are hard solids with high melting points.
- (C) Silver and copper are the best conductors of heat and electricity among all metals.
- (D) Gold is highly ductile – one gram of it can be drawn into a very long, thin wire.

A Mercury is a metal that exists as a liquid at room temperature.

B Alkali metals such as sodium and potassium have high densities and high melting points.

C Silver and copper are the best conductors of heat among metals.

D Gold is the most ductile metal, and a wire of about 2 km can be drawn from one gram of it.

◆ Metals and Non-metals

Q6. medium thorough-understanding § 3.2 CHEMICAL PROPERTIES OF METALS [3]

Sodium and potassium react violently with cold water, while calcium's reaction is comparatively less vigorous. State two observations that distinguish sodium's reaction with cold water from calcium's reaction, and give reasons for these differences.

◆ Metals and Non-metals

Q7. medium thorough-understanding § 3.2 CHEMICAL PROPERTIES OF METALS [3]

When iron reacts with steam, the product is Fe_3O_4 , not Fe_2O_3 . Write the balanced chemical equation for this reaction and explain why iron cannot be used instead of magnesium in a reaction with cold water to produce hydrogen gas in the laboratory.

◆ Metals and Non-metals

Q8. medium thorough-understanding § 3.2 CHEMICAL PROPERTIES OF METALS [1]

Which of the following correctly explains why hydrogen gas is NOT produced when copper reacts with dilute hydrochloric acid?

- (A) Copper reacts with HCl to form an insoluble salt that blocks further reaction.
- (B) Copper lies below hydrogen in the reactivity series and therefore cannot displace hydrogen from an acid.
- (C) Copper reacts with HCl but the hydrogen produced immediately reacts back with copper.
- (D) Copper requires concentrated acid, not dilute acid, to produce hydrogen.

A Copper reacts with HCl to form an insoluble salt that blocks further reaction.

B Copper lies below hydrogen in the reactivity series and therefore cannot displace hydrogen from an acid.

C Copper reacts with HCl but the hydrogen produced immediately reacts back with copper.

D Copper requires concentrated acid, not dilute acid, to produce hydrogen.

◆ Metals and Non-metals

Q9. medium thorough-understanding § 3.2 CHEMICAL PROPERTIES OF METALS [3]

A student adds a piece of zinc to copper sulphate solution and observes that the blue colour of the solution gradually fades and a reddish-brown deposit forms on the zinc. (i) Write the balanced chemical equation for this reaction. (ii) Identify the type of reaction. (iii) What does this result tell you about the relative reactivities of zinc and copper?

◆ Metals and Non-metals

Q10. medium thorough-understanding § 3.2 CHEMICAL PROPERTIES OF METALS [3]

Aluminium oxide reacts with both hydrochloric acid and sodium hydroxide solution. Write the chemical equations for both reactions and explain what property of aluminium oxide these reactions demonstrate.

◆ Metals and Non-metals

Q11. deep thorough-understanding § 3.2 CHEMICAL PROPERTIES OF METALS [3]

Hydrogen gas is not evolved when most metals react with nitric acid, yet it IS evolved when magnesium reacts with very dilute nitric acid. What property of nitric acid accounts for the usual absence of hydrogen gas, and what does the exception with very dilute HNO_3 and magnesium suggest about the conditions needed for this property to operate?

◆ Metals and Non-metals

Q12. deep thorough-understanding § 3.2 CHEMICAL PROPERTIES OF METALS [2]

Metal X displaces metal Y from Y's sulphate solution, but metal Y cannot displace metal Z from Z's sulphate solution, whereas metal X can displace metal Z. Arrange X, Y and Z in decreasing order of reactivity, justifying each step of your reasoning using the concept of displacement reactions.

◆ Metals and Non-metals

Q13. deep thorough-understanding § 3.2 CHEMICAL PROPERTIES OF METALS [2]

During the burning of metals in air, iron filings burn vigorously when sprinkled into a flame, yet a solid piece of iron does not burn even on strong heating. What does this tell you about the factor(s) that determine the rate at which a metal reacts with oxygen, beyond just its position in the reactivity series?

◆ Metals and Non-metals

Q14. medium thorough-understanding § 3.3 HOW DO METALS AND NON-METALS REACT? [3]

Using electronic configurations, explain why magnesium chloride has the formula MgCl_2 while sodium chloride has the formula NaCl . (Atomic numbers: Na = 11, Mg = 12, Cl = 17)

◆ Metals and Non-metals

Q15. medium thorough-understanding § 3.3 HOW DO METALS AND NON-METALS REACT? [3]

An ionic compound dissolves readily in water but does not conduct electricity in the solid state. However, when melted, the same compound conducts electricity. Why does changing the physical state from solid to liquid enable electrical conduction?

◆ Metals and Non-metals

Q16. straightforward thorough-understanding § 3.3 HOW DO METALS AND NON-METALS REACT? [1]

Which of the following statements correctly explains why ionic compounds have high melting points?

- (A) The molecules of ionic compounds are very large and tightly packed.
- (B) A large amount of energy is needed to overcome the strong electrostatic forces between oppositely charged ions.
- (C) Ionic compounds consist of neutral atoms held together by weak intermolecular forces.
- (D) The electrons shared between ions create a strong covalent bond that is hard to break.

A The molecules of ionic compounds are very large and tightly packed.

B A large amount of energy is needed to overcome the strong electrostatic forces between oppositely charged ions.

C Ionic compounds are insoluble in water, so they require more heat to melt.

D The electrons shared between ions create a strong covalent bond that is hard to break.

◆ Metals and Non-metals

Q17. deep thorough-understanding § 3.3 HOW DO METALS AND NON-METALS REACT? [5]

A student claims that since aluminium (atomic number 13) is a reactive metal, it should form an ionic compound with fluorine (atomic number 9) in which one aluminium ion bonds with one fluoride ion. Identify the error in this claim and show, using electronic configurations, the correct formula of the ionic compound formed.

◆ Metals and Non-metals

Q18. medium thorough-understanding § 3.4 OCCURRENCE OF METALS [2]

Gold and silver are found in nature as free elements, while metals like sodium and calcium are never found in free form. What fundamental property of a metal determines whether it occurs in nature as a free element or in a combined state?

◆ **Metals and Non-metals**

Q19. medium thorough-understanding § 3.4 OCCURRENCE OF METALS [3]

[short_answer] Zinc sulphide (ZnS) and zinc carbonate (ZnCO₃) are two common ores of zinc. (i) Name the process used to convert each of these ores into zinc oxide (ZnO). (ii) Why must these ores be converted to the oxide form before the metal can be extracted by reduction with carbon, rather than reducing them directly?

◆ **Metals and Non-metals**

Q20. deep thorough-understanding § 3.4 OCCURRENCE OF METALS [3]

Carbon (coke) is an effective reducing agent for extracting iron and zinc from their oxides, but it cannot be used to extract sodium or aluminium from their oxides. Why not? How are sodium and aluminium extracted instead?

◆ **Metals and Non-metals**

Q21. medium thorough-understanding § 3.4 OCCURRENCE OF METALS [1]

[mcq] In the thermit reaction, iron(III) oxide is reduced to produce molten iron. Which of the following correctly identifies the reducing agent used and the reason carbon cannot be used instead?

- (A) Carbon; it has a higher affinity for oxygen than aluminium at high temperatures
- (B) Aluminium; it is more reactive than iron and has a higher affinity for oxygen than carbon at the reaction temperature
- (C) Aluminium; it is less reactive than iron, so it does not interfere with the product
- (D) Carbon; it is cheaper and more readily available than aluminium

A Aluminium is cheaper and more readily available than carbon.

B Aluminium is more reactive than iron and has a greater affinity for oxygen than carbon does at the temperatures involved.

C Carbon would produce a poisonous gas, making it unsafe to use.

D Aluminium has a lower melting point than carbon, making it easier to ignite.

◆ **Metals and Non-metals**

Q22. deep thorough-understanding § 3.4 OCCURRENCE OF METALS [3]

In electrolytic refining of copper, explain what happens at each electrode during the process. Why do the insoluble impurities not get deposited on the cathode along with the pure copper?

◆ **Metals and Non-metals**

Q23. medium thorough-understanding § 3.5 CORROSION [3]

Iron nails are placed in three separate test tubes: one containing ordinary water open to air, one containing boiled distilled water sealed with a layer of oil, and one containing only dry air with a desiccant. After several days, predict in which test tube rusting will be observed and in which it will not. Give reasons for your answer and state the conditions necessary for iron to rust.

◆ **Metals and Non-metals**

Q24. deep thorough-understanding § 3.5 CORROSION [3]

Zinc is used to coat iron articles to protect them from rusting (galvanisation). Even if the zinc coating gets scratched or broken, the iron underneath still does not rust immediately. Using your knowledge of the reactivity series, explain why this is so.

◆ **Metals and Non-metals**

Q25. medium thorough-understanding § 3.5 CORROSION [1]

Pure iron is too soft and corrodes easily, so it is alloyed to make stainless steel. Which of the following correctly identifies the elements added and the primary properties they impart?

- (A) Nickel and copper – to increase malleability and electrical conductivity
- (B) Carbon and chromium – to increase hardness and resistance to corrosion
- (C) Carbon and manganese – to lower melting point and increase lustre
- (D) Chromium and copper – to increase ductility and make it lighter

- A To increase its melting point and make it lustrous
- B To make it hard and resistant to corrosion
- C To increase its electrical conductivity and ductility
- D To make it lighter and more malleable

◆ Metals and Non-metals

Q26. medium thorough-understanding § (whole-chapter synthesis) [3]

A student claims: 'Aluminium is highly reactive, so it should corrode rapidly in air and be useless for making cooking utensils.' Identify the flaw in this reasoning and explain, using aluminium's chemical behaviour, why this claim is incorrect.

◆ Metals and Non-metals

Q27. medium thorough-understanding § (whole-chapter synthesis) [3]

Zinc can be extracted from zinc oxide by heating with carbon, but sodium cannot be extracted from sodium oxide the same way. Explain why these two metals require fundamentally different extraction methods, linking your answer to a property that distinguishes them.

◆ Metals and Non-metals

Q28. deep thorough-understanding § (whole-chapter synthesis) [3]

An alloy of copper and zinc does not conduct electricity as well as pure copper, even though both copper and zinc are good conductors individually.

- (i) What general rule about alloys does this observation illustrate?
- (ii) Despite being a good conductor of heat, copper is alloyed with zinc to make brass for many household items instead of being used as pure copper. State one advantage of using brass over pure copper for such applications.

◆ Metals and Non-metals

Q29. medium thorough-understanding § (whole-chapter synthesis) [5]

Trace the complete journey of zinc from its naturally occurring sulphide ore to a pure, usable metal. Your answer must include: the reason its ore form must be converted before reduction, the two processes used for this conversion and what they involve, the reduction step, and how the final impure metal is purified.

◆ Metals and Non-metals

Q30. deep thorough-understanding § (whole-chapter synthesis) [3]

Both the formation of ionic compounds (e.g., NaCl from sodium and chlorine) and the extraction of highly reactive metals by electrolysis of their molten ores share the same fundamental chemical tendency of metals. Identify this tendency and explain how it drives both processes – one leading to compound formation and the other to isolation of the pure metal.

◆ Metals and Non-metals

Q31. deep thorough-understanding § (whole-chapter synthesis)

[3]

Non-metals and metals both react with oxygen, yet the oxides they form behave oppositely when dissolved in water. Explain this difference in behaviour with one example each. Additionally, explain how the electronic configurations of a typical metal and a typical non-metal make their reaction with each other a 'give-and-take' process, and what type of compound results from this process.

◆ Metals and Non-metals

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