

CBSE CLASS X
Science (086)**ANSWER KEY***From previous CBSE Board Exam questions***Code: SOPF86****Questions: 93****Maximum Marks: 147****Generated: 2026-06-15 12:52****SELECTIONS USED**

Source	Previous-year board
Subject	Science
Lessons	Chemical Reactions and Equations
Year	2022-2026
Questions selected	93

Composition — Types: 44 MCQ · 25 Short · 17 Very short · 6 Assertion–reason · 2 Long

Q1. § Chapter Introduction § 1.1.1 Writing a Chemical Equation § 1.2 TYPES OF CHEMICAL REACTIONS

[3]

With the help of an appropriate example, justify that some of the chemical reactions are determined by

- (a) Change in temperature,
- (b) Evolution of a gas, and
- (c) Change in colour

Give chemical equation for the reaction involved in each case.

Previously asked in: 2023 31/6/1 Q30

♦ Chemical Reactions and Equations

Indicators of Chemical Reactions – Change in Colour

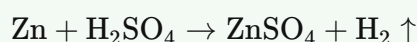
Indicators of Chemical Reactions – Change in Temperature

Indicators of Chemical Reactions – Evolution of Gas

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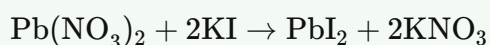
Model Answer

(a) Change in temperature: When zinc reacts with dilute sulphuric acid, heat is evolved, showing a rise in temperature (exothermic reaction).



(b) Evolution of a gas: The same reaction above also produces hydrogen gas, which can be observed as bubbles around the zinc granules.

(c) Change in colour: When potassium iodide solution is added to lead nitrate solution, a yellow precipitate of lead iodide is formed, indicating a change in colour.



Source: Chapter 1, Section 1.1 (Activities 1.2 and 1.3)

Explanation

- Examiners look for **one clear example per observation** with a correct chemical equation.
- For (a) and (b), the same $\text{Zn} + \text{H}_2\text{SO}_4$ reaction is acceptable for both, as it shows both temperature change and gas evolution — but state each observation separately.
- For (c), the lead nitrate + potassium iodide reaction is the textbook example (yellow PbI_2 precipitate).
- Make sure arrows ($\uparrow$ for gas, $\downarrow$ for precipitate) are included — they fetch marks.
- Each sub-part carries 1 mark; losing the equation loses half the mark for that part.

Q2. § Chapter Introduction**[2]**

A student performs the following experiment in his school laboratory.

List two observations to justify that in this experiment a chemical change has taken place.

Previously asked in: 2025 31/1/1 Q21

♦ Chemical Reactions and Equations

Observations indicating a chemical change (chemical reaction)

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Model Answer

Two observations that justify a chemical change has taken place:

1. **Evolution of gas** — Bubbles of gas are produced during the reaction (e.g., hydrogen gas is evolved when acid reacts with zinc granules).
1. **Change in temperature** — The test tube/conical flask becomes warm, indicating heat is released, showing a chemical change has occurred.

Source: Chapter 1, Chemical Reactions and Equations

Explanation

The textbook (Activity 1.3) specifically lists four indicators of a chemical reaction: change in state, change in colour, evolution of a gas, and change in temperature. Since the figure likely shows acid + zinc (like Fig. 1.2), the two most relevant observations are gas evolution and temperature change. Pick any two valid indicators from the textbook list and briefly explain each — examiners award 1 mark per correct observation.

Q3. § 1.2 TYPES OF CHEMICAL REACTIONS**[1]**

In which one of the following situations a chemical reaction does not occur?

- (a) Milk is left open at room temperature during summer
- (b) Grapes get fermented
- (c) An iron nail is left exposed to humid atmosphere
- (d) Melting of glaciers

Previously asked in: 2025 31/4/1 Q1

♦ Chemical Reactions and Equations

Identification of situations where chemical reactions occur or do not occur

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Model Answer**(d) Melting of glaciers**

Melting of glaciers is a physical change (change of state from solid to liquid); no new substance is formed, so no chemical reaction occurs.

Explanation

The textbook's Chapter 1 introduction lists milk souring, iron rusting, and grape fermentation as examples where chemical reactions take place (identity of substance changes). Melting is purely a physical change — only the state changes, not the chemical composition. Examiners expect students to distinguish physical changes from chemical reactions.

Q4. § 1.2.5 Oxidation and Reduction

[1]

To a small amount of copper oxide in a beaker, when we add dilute hydrochloric acid slowly with stirring, the change in the colour of the solution is due to the formation of :

- (A) Copper(II) oxide, which is black in colour.
- (B) Copper(I) chloride, which is blue in colour.
- (C) Copper(II) chloride, which is blue-green in colour.
- (D) Copper(I) oxide, which is black in colour.

Previously asked in: 2026 31/3/1 Q18

♦ Chemical Reactions and Equations

Reaction of metal oxides with acids

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Model Answer

(C) Copper(II) chloride, which is blue-green in colour.

Explanation

Activity 2.7 (Chapter 2) directly states that the solution turns blue-green due to the formation of copper(II) chloride when copper oxide reacts with dilute HCl: $\text{CuO} + 2\text{HCl} \rightarrow \text{CuCl}_2 + \text{H}_2\text{O}$. Remember: metal oxide + acid $\rightarrow$ salt + water.

Q5. § 1.1 CHEMICAL EQUATIONS

[1]

Select from the following a statement which is not true about burning of magnesium ribbon in air :

- (A) It burns with a dazzling white flame.
- (B) A white powder is formed on burning.
- (C) It is an endothermic reaction.
- (D) It is an example of a combination reaction.

Previously asked in: 2025 31/6/1 Q3

♦ Chemical Reactions and Equations

Burning of Magnesium Ribbon – Observations and Characteristics

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Model Answer

(C) It is an endothermic reaction.

Burning of magnesium is an *exothermic* reaction (releases heat and light). It burns with a dazzling white flame, forms white magnesium oxide powder, and is a combination reaction — all true statements.

Explanation

The textbook (Activity 1.1, Ch. 1) states magnesium burns with a dazzling white flame forming white powder (MgO) — a combination reaction releasing energy, making it **exothermic**, not endothermic. Endothermic reactions *absorb* energy; exothermic reactions *release* it. Examiners expect you to know this distinction clearly.

Q6. § 1.1 CHEMICAL EQUATIONS § 1.1.1 Writing a Chemical Equation**[1]**

Electrolysis of water is a decomposition reaction. The mass ratio (MH : MO) of hydrogen and oxygen gases liberated at the electrodes during electrolysis of water is :

- (A) 8 : 1
- (B) 2 : 1
- (C) 1 : 2
- (D) 1 : 8

Previously asked in: 2025 31/1/1 Q1

♦ Chemical Reactions and Equations

Electrolysis of water – mass ratio of hydrogen and oxygen liberated

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Model Answer**(D) 1 : 8**

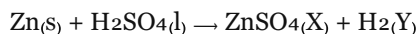
The balanced equation is $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$. Mass of $\text{H}_2 = 4$ g, mass of $\text{O}_2 = 32$ g, so $M_{\text{H}} : M_{\text{O}} = 4 : 32 = 1 : 8$.

Explanation

The question asks for the **mass ratio**, not the mole or volume ratio. From the balanced equation, 2 moles of H_2O give 2 moles of H_2 (mass = 4 g) and 1 mole of O_2 (mass = 32 g). So the mass ratio is 1 : 8. A common mistake is to pick 1 : 2 (mole ratio) instead of the mass ratio.

Q7. § 1.1 CHEMICAL EQUATIONS**[1]**

Select the appropriate state symbols of the products given as X and Y in the following chemical equation by choosing the correct option from table given below :



- (a) (X) (s), (Y) (l)
- (b) (X) (aq), (Y) (g)
- (c) (X) (aq), (Y) (s)
- (d) (X) (g), (Y) (aq)

Previously asked in: 2023 31/6/1 Q3

♦ Chemical Reactions and Equations

State symbols in chemical equations

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Model Answer**(b) X = (aq), Y = (g)**

ZnSO_4 dissolves in water to form an aqueous solution, and H_2 is released as a gas.

Explanation

When zinc reacts with dilute H_2SO_4 , ZnSO_4 (zinc sulphate) is soluble in water, so its state symbol is **(aq)**. Hydrogen is produced as a gas, so its state symbol is **(g)**. This is a standard displacement reaction from Chapter 1.

Q8. § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations

[1]

In order to balance the following chemical equation, the values of the coefficients x and y respectively are :



- (a) 2, 4
- (b) 2, 2
- (c) 2, 3
- (d) 4, 2

Previously asked in: 2023 31/2/1 Q3

♦ Chemical Reactions and Equations

Balancing chemical equations by finding stoichiometric coefficients

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Model Answer**(a) 2, 4**

Balanced equation: $2 \text{Pb}(\text{NO}_3)_2 \rightarrow 2 \text{PbO} + 4 \text{NO}_2 + \text{O}_2$. So x = 2 and y = 4.

Explanation

Check atom balance: with x = 2, y = 4 — Pb: 2 = 2 ✓; N: 4 = 4 ✓; O: 12 = 2+8+2 = 12 ✓. The law of conservation of mass (equal atoms on both sides) confirms option (a).

Q9. § 1.2.4 Double Displacement Reaction

[1]

In the following equation



x and y respectively are :

- (A) 2, 2
- (B) 1, 2
- (C) 2, 1
- (D) 1, 1

Previously asked in: 2026 31/3/1 Q19

♦ Chemical Reactions and Equations

Balancing chemical equations

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Model Answer

Balancing the equation: $2\text{KI} + \text{H}_2\text{O}_2 \rightarrow \text{I}_2 + 2\text{KOH}$

LHS: 2K, 2I, 2H, 2O — RHS: 2K, 2I, 2H, 2O ✓

So x = 2 and y = 2. **Answer: (A) 2, 2**

Explanation

Balance by inspection: 2 KI provides 2 I atoms (needed for I₂) and 2 K atoms, which combine with the 2 OH from H₂O₂ to give 2 KOH. Both x and y are 2. Always verify atom count on both sides for balancing MCQs.

Q10. § 1.1 CHEMICAL EQUATIONS § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations**[3]**

Write balanced chemical equation for the reactions that occur when

- (a) steam is passed over red hot iron.
- (b) natural gas is burnt in air.
- (c) glucose reacts with oxygen in the cells of our body and provides energy.

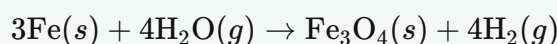
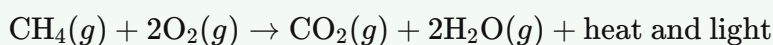
Previously asked in: 2025 31/6/1 Q27

♦ Chemical Reactions and Equations

Balanced chemical equations for combustion reactions (natural gas, glucose)

Balanced chemical equations for reactions involving steam and iron

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Model Answer**(a) Steam passed over red hot iron:****(b) Natural gas (methane) burnt in air:****(c) Glucose reacting with oxygen in body cells:**

Source: Chapter 1 – Chemical Reactions and Equations; Chapter 4 – Carbon and its Compounds, Section 4.3.1

Explanation

- **(a)** is a displacement/redox reaction — iron displaces hydrogen from steam forming iron oxide (Fe_3O_4). Students often forget the coefficient 4 on both H_2O and H_2 .
- **(b)** Natural gas = methane (CH_4). The balanced equation requires coefficient 2 before O_2 . Always mention heat and light for combustion.
- **(c)** This is cellular respiration — an exothermic reaction. Write "energy" (not just heat) as the product. Balancing correctly (6 on O_2 , CO_2 , and H_2O) is key for full marks.
- Each equation carries **1 mark** — a missing or wrong coefficient loses the mark, so double-check balancing.

Q11. § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations § 1.2.5 Oxidation and Reduction

[2]

(A) A student took a small amount of copper oxide in a conical flask and added dilute hydrochloric acid to it with constant stirring. He observed a change in colour of the solution.

(i) Write the name of the compound formed and its colour.

(ii) Write a balanced chemical equation for the reaction involved.

Previously asked in: 2023 31/4/1 Q21 (A)

♦ Chemical Reactions and Equations

Balancing chemical equations

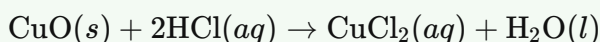
Reaction of metal oxides with acids

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Model Answer

(i) The compound formed is **copper(II) chloride**. Its colour is **blue-green**.

(ii) Balanced chemical equation:



Source: Chapter 2, Section 2.1.5 (Reaction of Metallic Oxides with Acids)

Explanation

- The passage (Activity 2.7) explicitly states the solution turns **blue-green** due to formation of **copper(II) chloride** — use the exact name and colour.
- The balanced equation follows the general pattern: Metal oxide + Acid → Salt + Water. Ensure coefficient **2** before HCl to balance the equation — this is a commonly tested balancing point.
- State symbols (s), (aq), (l) add marks if included.

Q12. § 1.1.2 Balanced Chemical Equations

[1]

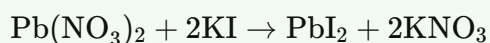
Answer the following : Balance the following chemical reaction : $\text{Pb}(\text{NO}_3)_2 + \text{KI} \rightarrow \text{PbI}_2 + \text{KNO}_3$

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

♦ Chemical Reactions and Equations

Balancing chemical equations

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Model Answer

Source: Chemical Reactions and Equations, Section 1.1.2

Explanation

Check atom count: Pb=1, N=2, O=6, K=2, I=2 on both sides — equation is balanced by placing coefficient **2** before KI and **2** before KNO₃. The formulae of compounds must not be changed; only coefficients are adjusted (hit-and-trial method).

Q13. § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations

[1]

The correct balanced chemical equation showing exothermic reaction in which natural gas burns in air is :

- (A) $\text{CH}_4 + \text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
(B) $\text{CH}_4 + 2\text{O}_2 \longrightarrow 2\text{CO}_2 + 2\text{H}_2\text{O} + \text{Energy}$
(C) $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
(D) $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{Energy}$

Previously asked in: 2025 31/2/1 Q1

♦ Chemical Reactions and Equations

Combustion reactions and balancing chemical equations

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Model Answer

(D) $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{Energy}$

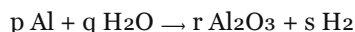
Explanation

The equation must be **balanced** (2O₂ on LHS; 1C, 4H, 4O on each side) **and** show **energy released** (exothermic). Option A is unbalanced; B has wrong products (2CO₂); C is balanced but missing energy. Only D is both correctly balanced and shows energy as a product of this exothermic combustion reaction.

Q14. § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations

[1]

Consider the following chemical equation :



To balance this chemical equation, the values of 'p', 'q', 'r' and 's' must be respectively :

- (A) 3, 2, 2, 1
(B) 2, 3, 3, 1
(C) 2, 3, 1, 3
(D) 3, 1, 2, 2

Previously asked in: 2025 31/3/1 Q1

♦ Chemical Reactions and Equations

Balancing chemical equations

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Model Answer

(C) 2, 3, 1, 3

Balancing: $2\text{Al} + 3\text{H}_2\text{O} \longrightarrow \text{Al}_2\text{O}_3 + 3\text{H}_2$ (Al: 2=2, O: 3=3, H: 6=6). ✓

Explanation

Balance by hit-and-trial: start with Al₂O₃ (needs 2 Al on LHS), then balance O by putting 3H₂O, which gives 6 H atoms, requiring 3H₂ on RHS. Always verify all atoms on both sides after assigning coefficients.

Q15. § 1.1.2 Balanced Chemical Equations

[1]

Consider the following Chemical equation : $a \text{Al}_2\text{O}_3 + b \text{HCl} \rightarrow c \text{AlCl}_3 + d \text{H}_2\text{O}$. In order to balance this chemical equation, the values of a, b, c and d must be

- A 1, 6, 2 and 3
- B 1, 6, 3 and 2
- C 2, 6, 2 and 3
- D 2, 6, 3 and 2

Previously asked in: 2024 31/3/1 Q5

♦ Chemical Reactions and Equations

Balancing chemical equations

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Model Answer**(A) 1, 6, 2 and 3**

Balancing: $\text{Al}_2\text{O}_3 + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2\text{O}$. Al: 2=2, Cl: 6=6, O: 3=3, H: 6=6. So a=1, b=6, c=2, d=3.

Explanation

Balance Al first (2 on LHS $\rightarrow$ c=2), then Cl (6 on RHS $\rightarrow$ b=6), then check H and O (6H gives 3H₂O). The correct coefficients are 1, 6, 2, 3 — option A. Watch out for option D which incorrectly doubles all terms.

Q16. § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations

[1]

$\text{MnO}_2 + x \text{HCl} \rightarrow \text{MnCl}_2 + y \text{H}_2\text{O} + z \text{Cl}_2$

In order to balance the above chemical equation, the values of x, y and z respectively are :

- (a) 6, 2, 2
- (b) 4, 1, 2
- (c) 4, 2, 1
- (d) 2, 2, 1

Previously asked in: 2023 31/1/1 Q3

♦ Chemical Reactions and Equations

Balancing chemical equations

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Model Answer**(c) 4, 2, 1**

Balancing: $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$. Mn=1, O=2, H=4, Cl=4 on both sides. So x=4, y=2, z=1.

Explanation

Balance each element: 4 HCl provides 4 Cl atoms — 2 go to MnCl₂ and 2 form 1 Cl₂; 4 H atoms form 2 H₂O; 2 O atoms (from MnO₂) form 2 H₂O. All atoms balance. Examiners expect the correct option with brief verification.

Q17. § 1.1.2 Balanced Chemical Equations**[1]**

To balance the following chemical equation, the values of the coefficients x, y and z must be respectively :



- (A) 4, 2, 2
- (B) 4, 4, 2
- (C) 2, 2, 4
- (D) 2, 4, 2

Previously asked in: 2024 31/5/1 Q1

♦ Chemical Reactions and Equations

Balancing chemical equations by finding stoichiometric coefficients

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Model Answer**(C) 2, 2, 4**

Balanced equation: $2 \text{Zn}(\text{NO}_3)_2 \rightarrow 2 \text{ZnO} + 4 \text{NO}_2 + \text{O}_2$. Here $x = 2$, $y = 2$, $z = 4$.

Explanation

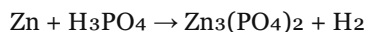
Balance each element: LHS has 2 Zn, 4 N, 12 O. RHS: 2 ZnO (2 Zn, 2 O) + 4 NO₂ (4 N, 8 O) + O₂ (2 O) = 2 Zn, 4 N, 12 O. ✓ The hit-and-trial method from Chapter 1 is used here. Note option (C) gives the smallest whole-number coefficients that satisfy conservation of mass.

Q18. § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations

[3]

Why do we balance a chemical equation? Name and state the law that suggests the balancing of a chemical equation?

Balance the following chemical equation :



Previously asked in: 2025 31/4/1 Q27(A)

♦ Chemical Reactions and Equations

Balancing chemical equations

Law of Conservation of Mass

Need for balancing a chemical equation

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Model Answer

Why we balance a chemical equation:

A chemical equation is balanced to satisfy the **Law of Conservation of Mass**.

Law: Mass can neither be created nor destroyed in a chemical reaction. Therefore, the number of atoms of each element must be the same on both sides (reactant and product side) of the equation.

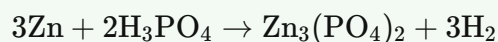
Balancing the equation:



Count atoms:

- Zn: LHS = 1, RHS = 3 → put coefficient 3 before Zn
- PO₄: LHS = 1, RHS = 2 → put coefficient 2 before H₃PO₄
- H: LHS = 6 (2×3), RHS = 2 → put coefficient 3 before H₂

Balanced equation:



Verification: Zn=3, H=6, P=2, O=8 on both sides. ✓

Source: Chapter 1, Section 1.1.2

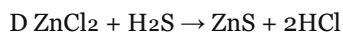
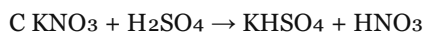
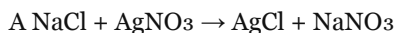
Explanation

- **1 mark** for stating the reason (Law of Conservation of Mass).
- **1 mark** for naming and stating the law correctly.
- **1 mark** for the correctly balanced equation.
- Always verify atom count on both sides — examiners check this. Use only coefficients, never change subscripts inside formulae.

Q19. § 1.1 CHEMICAL EQUATIONS § 1.1.2 Balanced Chemical Equations § 1.2 TYPES OF CHEMICAL REACTIONS

[1]

Which one of the following reactions is different from the remaining three ?



Previously asked in: 2024 31/3/1 Q7

♦ Chemical Reactions and Equations

Types of Chemical Reactions

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Model Answer

Answer: (B)

$\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$ is a **combination reaction**, while reactions A, C, and D are all **double displacement reactions** (two ions/groups are exchanged between reactants).

Source: Chapter 1, Chemical Reactions and Equations

Explanation

- **Double displacement:** two different ions/groups exchange between two compounds (A, C, D all fit this pattern).
- **Combination reaction:** two substances combine to form a single new substance — that's what B shows ($\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$).
- Examiners expect you to identify the **odd one out by reaction type**. Name the type for option B and briefly state why A, C, D belong to the same category.

Q20. § 1.1 CHEMICAL EQUATIONS

[1]

The main observations while performing the experiment of burning magnesium ribbon in air are :

- (i) Magnesium ribbon burns with a dazzling white flame.
- (ii) A white powder is formed.
- (iii) Magnesium ribbon vapourises.
- (iv) Aqueous solution of the white powder turns blue litmus to red.

- A (i) and (iv)
- B (ii) and (iii)
- C (i) and (ii)
- D (iii) and (iv)

Previously asked in: 2025 31/5/1 Q1

♦ Chemical Reactions and Equations

Burning of magnesium ribbon in air – observations and products

Combination reaction

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Model Answer**C – (i) and (ii)**

When magnesium ribbon is burnt in air, it burns with a **dazzling white flame** and forms a **white powder** (magnesium oxide). Magnesium does not vapourise, and MgO dissolved in water gives a basic solution (turns red litmus blue, not blue litmus red).

Explanation

Observation (i) is directly stated in Activity 1.1: "magnesium ribbon burns with a dazzling white flame."

Observation (ii) is also confirmed: "changes into a white powder" (MgO). Option (iii) is wrong – magnesium burns, it does not simply vapourise. Option (iv) is wrong – MgO is a basic oxide; its aqueous solution turns red litmus blue, not blue litmus red. Examiners expect students to eliminate incorrect observations using their knowledge of the nature of MgO.

Q21. § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations

[1]

The balanced chemical equation showing reaction between quicklime and water is :

- (a) $2 \text{CaO} + \text{H}_2\text{O} \rightarrow 2 \text{CaOH} + \text{H}_2 + \text{Heat}$
- (b) $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{H}_2 + \text{Heat}$
- (c) $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{Heat}$
- (d) $2 \text{CaO} + 3 \text{H}_2\text{O} \rightarrow 2 \text{Ca(OH)}_3 + \text{O}_2 + \text{Heat}$

Previously asked in: 2023 31/5/1 Q2

♦ Chemical Reactions and Equations

Reaction of quicklime (CaO) with water – balanced chemical equation

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Model Answer**(c) $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{Heat}$** **Explanation**

The textbook (Eq. 1.13) clearly states: $\text{CaO(s)} + \text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)} + \text{Heat}$. Only one mole each of CaO and H₂O react to form one mole of Ca(OH)₂ with no H₂ or O₂ released. Options (a), (b), and (d) are unbalanced or show incorrect products.

Q22. § 1.2.1 Combination Reaction

[1]

Identify the product 'X' obtained in the following chemical reaction : $\text{CaCO}_3 \xrightarrow{\Delta} \text{'X'} + \text{CO}_2$

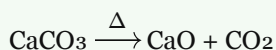
- A Quick lime
- B Gypsum
- C Lime Stone
- D Plaster of Paris

Previously asked in: 2024 31/3/1 Q1

♦ Chemical Reactions and Equations

Thermal decomposition reaction of CaCO_3 to CaO and CO_2

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Model Answer**Option A – Quick lime**

The product 'X' is **Quick lime** (Calcium oxide, CaO).

Source: Chapter 1, Section 1.2.1

Explanation

The thermal decomposition of calcium carbonate (limestone) gives calcium oxide (quick lime) and carbon dioxide. This is a standard decomposition reaction. The source passage (Ch. 1) identifies CaO as "Quick lime," which directly matches option A. Gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$) and Plaster of Paris are calcium sulphate compounds — unrelated to this reaction.

Q23. § 1.2.2 Decomposition Reaction § 1.2.3 Displacement Reaction

[1]

When ferrous sulphate crystals are heated in a test tube, we observe that :

- (A) A colourless gas with no smell is evolved.
- (B) A brown gas is evolved.
- (C) The green colour of the salt fades and a gas with the smell of burning sulphur is evolved.
- (D) The green colour of the salt fades and no gas is evolved.

Previously asked in: 2026 31/2/1 Q19

♦ Chemical Reactions and Equations

Thermal decomposition of ferrous sulphate

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Model Answer

(C) The green colour of the salt fades and a gas with the smell of burning sulphur is evolved.

Explanation

When FeSO_4 is heated, it decomposes into Fe_2O_3 , SO_2 , and SO_3 . The green colour fades ($\text{Fe}^{2+} \rightarrow \text{Fe}^{3+}$ forming red-brown Fe_2O_3) and SO_2/SO_3 gases produce the characteristic smell of burning sulphur. This is directly described in Activity 1.5 of Chapter 1.

Q24. § 1.2.2 Decomposition Reaction § 1.2.3 Displacement Reaction § 1.2.5 Oxidation and Reduction

Answer the following : Why do copper sulphate crystals turn white on heating ?

Previously asked in: 2023 31/5/1 Q28 (b)

♦ Chemical Reactions and Equations

Decomposition reaction – loss of water of crystallisation on heating

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Model Answer

Copper sulphate crystals are blue because they contain water of crystallisation ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$). On heating, they lose this water of crystallisation and turn white, forming anhydrous copper sulphate (CuSO_4). This is a decomposition reaction.



Source: Chapter 1, Section 1.2.2 Decomposition Reaction

Explanation

- The key concept here is **water of crystallisation** — the fixed number of water molecules present in one formula unit of a crystallised salt.
- Examiners expect you to name both forms: **$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$** (blue, hydrated) and **CuSO_4** (white, anhydrous).
- Mentioning it is a **decomposition reaction** (thermal decomposition) adds marks.
- The equation is important — write it correctly with the dot notation for water of crystallisation.

Q25. § 1.2.2 Decomposition Reaction § 1.2.4 Double Displacement Reaction**[2]**

What is observed when hydrated ferrous sulphate crystals are heated in a dry boiling tube ? Give balanced chemical equation(s) of the reaction(s) that occur(s).

Previously asked in: 2025 31/3/1 Q21(b)

♦ Chemical Reactions and Equations

Thermal decomposition of hydrated ferrous sulphate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$)

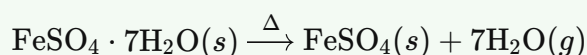
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Model Answer**Observations:**

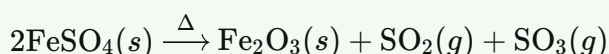
1. The green colour of hydrated ferrous sulphate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) crystals changes (first loses water, then turns reddish-brown).
2. A characteristic smell of burning sulphur (SO_2/SO_3 gases) is observed.

Chemical equations:

Step 1 – Loss of water on heating:



Step 2 – Thermal decomposition:



This is a **thermal decomposition** reaction.

Source: Chapter 1, Section 1.2.2 – Decomposition Reaction

Explanation

- Examiners expect **two observations**: colour change and smell of sulphur gases.
- Both equations must be written; some mark schemes award 1 mark for observations and 1 mark for the equation(s).
- The key equation tested is the decomposition one (eq. 1.19 from the textbook); including the dehydration step shows completeness.
- State symbols and the heat arrow (Δ) add accuracy and are good practice.

Q26. § 1.2.2 Decomposition Reaction**[1]**

The emission of brown fumes in the given experimental set-up is due to

- (a) thermal decomposition of lead nitrate which produces brown fumes of nitrogen dioxide.
- (b) thermal decomposition of lead nitrate which produces brown fumes of lead oxide.
- (c) oxidation of lead nitrate forming lead oxide and nitrogen dioxide.
- (d) oxidation of lead nitrate forming lead oxide and oxygen.

Previously asked in: 2023 31/1/1 Q2

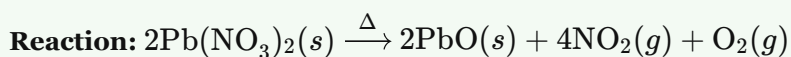
♦ Chemical Reactions and Equations

Formation of nitrogen dioxide (brown fumes) as a product of chemical reaction

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Model Answer**(a)**

The correct answer is **(a)**: thermal decomposition of lead nitrate which produces brown fumes of nitrogen dioxide.



The brown fumes are of NO_2 gas, produced by thermal decomposition (not oxidation) of lead nitrate.

Source: Chapter 1, Activity 1.6 — Decomposition Reaction

Explanation

- The key distinction: the reaction is **thermal decomposition** (a single reactant breaks down on heating), **not oxidation**.
- The brown fumes are specifically **nitrogen dioxide (NO_2)**, not lead oxide (PbO is a solid yellow powder, not a fume).
- Option (b) is wrong because PbO is a solid, not a fume.
- Options (c) and (d) are wrong because the reaction type is decomposition, not oxidation.
- Remember the balanced equation — it also produces O_2 , but the **visible brown fumes** are NO_2 only.

Q27. § 1.2.3 Displacement Reaction**[1]**

The colour of the solution observed after about 1 hour of placing iron nails in copper sulphate solution is

- (A) Blue
- (B) Pale green
- (C) Yellow
- (D) Reddish brown

Previously asked in: 2025 31/6/1 Q5

♦ Chemical Reactions and Equations

Displacement Reactions – colour change in copper sulphate solution with iron

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Model Answer**(B) Pale green**

Iron displaces copper from CuSO_4 , forming FeSO_4 (iron sulphate), which gives the solution a pale green colour.

Explanation

The reaction is: $\text{Fe(s)} + \text{CuSO}_4(\text{aq}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu(s)}$. Blue colour of CuSO_4 fades and pale green FeSO_4 forms. The iron nail also turns reddish-brown due to deposited copper. Examiners expect students to recall both the colour change of the solution (pale green) and its cause (FeSO_4 formation). Option (D) describes the nail, not the solution.

Q28. § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations § 1.2.4 Double Displacement Reaction

[3]

Define a precipitation reaction. Give its example and also express the reaction that occurs in the form of a balanced chemical equation.

Previously asked in: 2025 31/4/1 Q27(B)

♦ Chemical Reactions and Equations

Precipitation Reaction

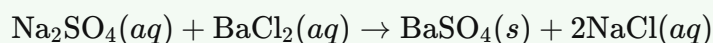
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Model Answer

Precipitation Reaction: Any reaction that produces an insoluble solid (called a precipitate) when two solutions are mixed is called a precipitation reaction.

Example: When sodium sulphate solution is mixed with barium chloride solution, a white insoluble precipitate of barium sulphate is formed.

Balanced Chemical Equation:



The white precipitate of BaSO_4 is formed by the reaction of SO_4^{2-} and Ba^{2+} ions. Sodium chloride remains dissolved in the solution.

Source: Chapter 1, Section 1.2.4 Double Displacement Reaction

Explanation

- **1 mark** for the definition (mention "insoluble substance/precipitate").
- **1 mark** for the example (naming both reactants and the precipitate formed).
- **1 mark** for the correctly balanced equation with state symbols — (aq), (s) are important; don't forget the coefficient **2** before NaCl.
- Examiners expect state symbols in the equation; missing them can cost half a mark.

Q29. § 1.2 TYPES OF CHEMICAL REACTIONS § 1.2.1 Combination Reaction § 1.2.4 Double Displacement Reaction

[2]

Answer the following:

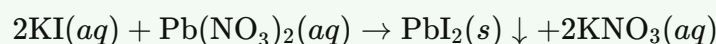
(a) What is observed when aqueous solutions of potassium iodide and lead nitrate are mixed together? Name the type of reaction and write the chemical equation for the reaction that occurs. [2]

Previously asked in: 2023 31/2/1 Q21

♦ Chemical Reactions and Equations

Double Displacement / Precipitation Reaction

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Model Answer**Observation:** A bright yellow precipitate of lead iodide (PbI_2) is formed.**Type of reaction:** Double displacement reaction (precipitation reaction).**Chemical equation:**

Source: Chapter 1, Chemical Reactions and Equations

Explanation

- The examiner expects **both** observation (yellow precipitate) and reaction type for full marks.
- This is both a **double displacement** and a **precipitation** reaction — either term or both is acceptable, but mentioning precipitation strengthens the answer.
- The equation must be **balanced** and **state symbols** (aq, s) should be included; the $\downarrow$ symbol for precipitate is good practice.
- "Bright yellow precipitate" is the key observable fact — don't just write "precipitate forms."

Q30. § 1.2 TYPES OF CHEMICAL REACTIONS § 1.2.1 Combination Reaction § 1.2.4 Double Displacement Reaction

[2]

(a) What is observed when aqueous solutions of potassium iodide and lead nitrate are mixed together? Name the type of reaction and write the chemical equation for the reaction that occurs.

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

♦ Chemical Reactions and Equations

Double Displacement / Precipitation Reaction

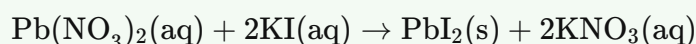
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Model Answer

Observation: A bright yellow precipitate is formed immediately.

Type of reaction: Double displacement reaction (precipitation reaction).

Chemical equation:



The yellow precipitate formed is lead iodide (PbI_2).

Source: Chapter 1, Exercises Q.15

Explanation

- **Two marks are split:** one for observation + type of reaction, one for the balanced equation.
- Always state the **colour** of the precipitate (yellow for PbI_2) — examiners specifically look for this.
- Label the precipitate with **(s)** and aqueous reactants/products with **(aq)** — state symbols are expected.
- "Double displacement" and "precipitation reaction" are **both acceptable** names; writing both is safest.
- The equation must be **balanced** (note the coefficient 2 before KI and KNO_3).

Q31. § 1.2.1 Combination Reaction § 1.2.4 Double Displacement Reaction

[1]

When aqueous solutions of potassium iodide and lead nitrate are mixed, an insoluble substance separates out. The chemical equation for the reaction involved is :

- (a) $\text{KI} + \text{PbNO}_3 \rightarrow \text{PbI} + \text{KNO}_3$
- (b) $2\text{KI} + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{PbI}_2 + 2\text{KNO}_3$
- (c) $\text{KI} + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{PbI} + \text{KNO}_3$
- (d) $\text{KI} + \text{PbNO}_3 \rightarrow \text{PbI}_2 + \text{KNO}_3$

Previously asked in: 2023 31/4/1 Q2

♦ Chemical Reactions and Equations

Double displacement and precipitation reactions

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Model Answer

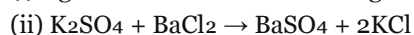
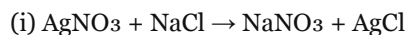
(b) $2\text{KI} + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{PbI}_2 + 2\text{KNO}_3$

Explanation

This is a double displacement (precipitation) reaction. Lead iodide (PbI_2) is the yellow insoluble precipitate. The equation must be balanced — 2 units of KI are needed to provide 2 iodide ions for one Pb^{2+} ion, making option (b) the only correctly balanced equation.

Q32. § 1.2.1 Combination Reaction § 1.2.4 Double Displacement Reaction

[1]



Which of the following options clearly describes both the reactions ?

- A (i) is double displacement, (ii) is displacement reaction.
B Both, (i) and (ii) are displacement reactions and precipitation reactions.
C Both, (i) and (ii) are double displacement reactions and precipitation reactions.
D (i) is displacement, (ii) is double displacement reaction.

Previously asked in: 2026 31/1/1 Q17

♦ Chemical Reactions and Equations

Double displacement and precipitation reactions

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Model Answer

Option C — Both (i) and (ii) are double displacement reactions and precipitation reactions, as ions are exchanged and insoluble precipitates AgCl and BaSO₄ are formed respectively.

Source: Chapter 1, Section 1.2.4 Double Displacement Reaction

Explanation

In both reactions, two compounds exchange their ions (double displacement). Both also produce an insoluble precipitate (AgCl↓ and BaSO₄↓), making them precipitation reactions too. Neither is a simple displacement (where one element replaces another). Examiners expect students to correctly identify **both** types simultaneously.

Q33. § 1.2.4 Double Displacement Reaction**[3]**

Define a double displacement reaction. Write the chemical equation of a double displacement reaction which is also a (i) Neutralization reaction and (ii) Precipitation reaction. Give justification for your answer.

Previously asked in: 2023 31/5/1 Q27

♦ Chemical Reactions and Equations

Double Displacement Reaction – Definition and Examples

Neutralization Reaction as Double Displacement

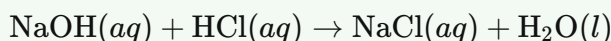
Precipitation Reaction as Double Displacement

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Model Answer

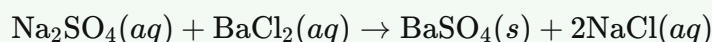
Double displacement reaction: A reaction in which two different ions are exchanged between the reactants to form two new compounds.

(i) Neutralization reaction (also double displacement):



Justification: Na^+ and H^+ ions exchange partners. It is a neutralization reaction because an acid (HCl) reacts with a base (NaOH) to form salt and water.

(ii) Precipitation reaction (also double displacement):



Justification: SO_4^{2-} and Cl^- ions exchange partners. It is a precipitation reaction because insoluble BaSO_4 (white precipitate) is formed as a product.

Source: Chapter 1 – Chemical Reactions and Equations, Section 1.2.4

Explanation

- **Definition:** Always mention "exchange of ions" — that is the key phrase examiners look for.
- **Neutralization:** Any acid + base $\rightarrow$ salt + water equation works; $\text{NaOH} + \text{HCl}$ is the standard textbook example.
- **Precipitation:** The BaSO_4 example is directly from the textbook (Activity 1.10); always write the state symbol (**s**) for the precipitate.
- **Justification:** For each, briefly state *why* it qualifies — this earns the explanation mark. Do not skip it.

Q34. § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations § 1.2.4 Double Displacement Reaction

[2]

"No precipitation reaction can occur without exchange of ions between the two reactants." Justify this statement giving a balanced chemical equation for the reaction.

Previously asked in: 2024 31/2/1 Q21(a)

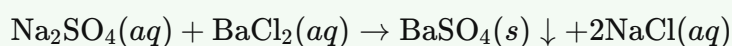
♦ Chemical Reactions and Equations

Precipitation Reaction and Double Displacement Reaction

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Model Answer

In a precipitation reaction, two soluble ionic compounds react by exchanging their ions, forming an insoluble precipitate. Without this exchange of ions (double displacement), no precipitate can form.

Example:

Here, Ba^{2+} and SO_4^{2-} ions exchange to form insoluble barium sulphate (white precipitate).

Source: Chapter 1, Section 1.2.4 Double Displacement Reaction

Explanation

- Examiners expect you to **link precipitation with double displacement** — both concepts appear together in NCERT.
- The key phrase is "**exchange of ions**": Ba^{2+} from BaCl_2 combines with SO_4^{2-} from Na_2SO_4 to form the precipitate BaSO_4 .
- Always include state symbols (aq), (s) and the $\downarrow$ arrow for the precipitate — these earn marks.
- 1 mark for the justification/explanation + 1 mark for the correct balanced equation.

Q35. § 1.2.5 Oxidation and Reduction**[2]**

Answer either (a) or (b):

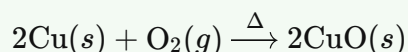
- (a)** Copper powder is taken in a china dish and heated over a burner. Name the product formed and state its colour. Write the chemical equation for the reaction involved. [2]

Previously asked in: 2024 31/5/1 Q21

♦ Chemical Reactions and Equations

Oxidation of copper – reaction with oxygen

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Model Answer**Product:** Copper oxide (CuO)**Colour:** Black**Chemical Equation:**

When copper is heated in air, it reacts with oxygen to form copper(II) oxide, which is black in colour. This is an oxidation reaction.

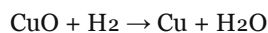
Source: *Chemical Reactions and Equations, Chapter 1 (also referenced in Exercise Q.17)*

Explanation

- This question is directly linked to Exercise Q.17 of Chapter 1, where element 'X' (shiny brown = copper) turns black on heating — the black compound is CuO.
- **Must include:** name of product, colour (black), and balanced equation — one mark each.
- Write the balanced equation correctly: **2Cu + O₂ → 2CuO** (coefficients are essential for full marks).
- Mentioning it is an oxidation/combination reaction adds value but is not strictly required for 2 marks.

Q36. § 1.2.5 Oxidation and Reduction**[2]**

Define oxidation. Identify and name the substance oxidised in the following reaction :



Previously asked in: 2025 31/4/1 Q21

♦ Chemical Reactions and Equations

Definition of Oxidation

Identifying the Oxidised Substance in a Redox Reaction

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Model Answer

Oxidation: If a substance gains oxygen (or loses hydrogen) during a reaction, it is said to be oxidised.

In the reaction $\text{CuO} + \text{H}_2 \rightarrow \text{Cu} + \text{H}_2\text{O}$, **hydrogen (H₂)** is oxidised because it gains oxygen to form water (H₂O).

Source: Chapter 1, Section 1.2.5 – Oxidation and Reduction

Explanation

- **1 mark** for the definition: must mention gain of oxygen (or loss of hydrogen).
- **1 mark** for correctly identifying and naming **hydrogen (H₂)** as the substance oxidised, with a brief reason (it gains oxygen).
- Do NOT say CuO is oxidised — CuO **loses** oxygen, so it is **reduced**.
- Always state *why* the substance is oxidised (gain of oxygen) to secure full marks.

Q37. § 1.3 HAVE YOU OBSERVED THE EFFECTS OF OXIDATION REACTIONS IN EVERYDAY LIFE?**[3]**

With the help of an activity, explain the conditions under which iron articles get rusted.

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

♦ Chemical Reactions and Equations

Conditions for Rusting of Iron (Activity-based explanation)

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Take three test tubes (A, B, C) with clean iron nails.

- **Test tube A:** Add water and cork it. (Nails exposed to both air and water)
- **Test tube B:** Add boiled distilled water + 1 mL oil, cork it. (Oil prevents air from dissolving; nails exposed to water only)
- **Test tube C:** Add anhydrous calcium chloride (absorbs moisture), cork it. (Nails exposed to dry air only)

Leave for a few days and observe.

Observation: Iron nails rust only in test tube A.

Conclusion: Iron rusts only when exposed to **both air (oxygen) and water simultaneously**. Presence of only water (B) or only dry air (C) does not cause rusting.

Source: Chapter 3, Section 3.5 (Activity 3.14)

Explanation

- Examiners expect the activity to be described with all three test tubes and their specific setups.
- The **role of each condition** (why oil is added, why anhydrous CaCl_2 is used) must be briefly stated.
- The **observation and conclusion** are mandatory for full marks — missing either loses a mark.
- Key phrase to include: *both air and water are necessary* for rusting.

Q38.**[1]**

Account for the following : Bags of oil and fat containing food items are flushed with nitrogen gas.

Previously asked in: 2026 31/4/1 Q26 (c)

♦ Chemical Reactions and Equations

Oxidation and Rancidity in Food

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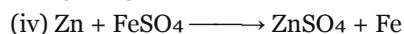
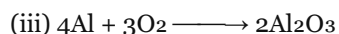
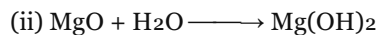
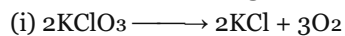
Nitrogen is an inert gas that does not react with food. It prevents oxidation (rancidity) of fats and oils, thereby keeping the food fresh for longer.

Explanation

The examiner expects students to state two points: (1) nitrogen is chemically inert/non-reactive, and (2) it prevents oxidation or rancidity of fats. This is a common application-based question from the Carbon and its Compounds chapter. Although the source passages do not directly state this, the concept links to unsaturated fats being prone to oxidation — nitrogen displaces oxygen, preventing this reaction.

Q39. § 1.1 CHEMICAL EQUATIONS § 1.2.1 Combination Reaction**[1]**

Which of the following are combination reactions ?



(A) (i) and (iii)

(B) (iii) and (iv)

(C) (ii) and (iv)

(D) (ii) and (iii)

Previously asked in: 2026 31/2/1 Q17

♦ Chemical Reactions and Equations

Combination Reactions

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Model Answer**(D) (ii) and (iii)**

In reaction (ii) $\text{MgO} + \text{H}_2\text{O} \rightarrow \text{Mg(OH)}_2$ and (iii) $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$, two reactants combine to form a single product — these are combination reactions.

Explanation

A combination reaction is one where two or more substances combine to form a single product. Reaction (i) is decomposition (one reactant $\rightarrow$ multiple products) and reaction (iv) is a displacement reaction. Examiners expect students to correctly identify the defining feature: **single product from multiple reactants**.

Q40. § 1.1.2 Balanced Chemical Equations § 1.2.2 Decomposition Reaction § 1.2.4 Double Displacement Reaction

[2]

Write balanced chemical equation for the reaction that occurs when :

- (i) blue coloured copper sulphate crystals are heated and
- (ii) Sodium hydrogen carbonate is heated during cooking.

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

♦ Chemical Reactions and Equations

Decomposition of copper sulphate crystals on heating

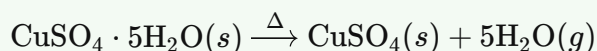
Decomposition of sodium hydrogen carbonate on heating

Thermal decomposition reactions – writing balanced chemical equations

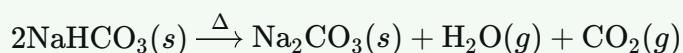
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Model Answer

(i) When blue copper sulphate crystals (hydrated) are heated, they lose water of crystallisation and turn white:



(ii) When sodium hydrogen carbonate is heated during cooking:



Source: Chapter 1, Chemical Reactions and Equations

Explanation

- (i) The key point is that hydrated copper sulphate (blue) loses 5 water molecules on heating to give anhydrous copper sulphate (white). Examiners expect the formula $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ on the LHS.
- (ii) This is a **thermal decomposition** reaction. The coefficient **2** before NaHCO_3 is essential for balancing. This reaction releases CO_2 , which makes dough/batter rise during cooking (baking soda).
- Always include the heat symbol (Δ) above the arrow since energy is supplied.

Q41. § 1.2.5 Oxidation and Reduction

[3]

Seema took a small amount of copper powder in a china dish and heated it. What changes will she observe on heating ? When H₂ gas is passed over this heated substance, what visible changes will be seen in it ? Give the chemical equations of the reactions involved, along with the names and colours of the products in each case.

Previously asked in: 2026 31/2/1 Q27

♦ Chemical Reactions and Equations

Oxidation and reduction reactions (redox reactions)

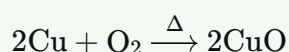
Oxidation of copper and reduction by hydrogen gas

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Model Answer

Observation on heating copper powder:

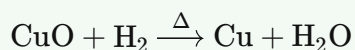
The surface of copper powder becomes coated with a **black** substance. This happens because copper reacts with oxygen in air to form **copper(II) oxide (CuO)**, which is black.



(Copper — reddish-brown; Copper(II) oxide — black)

On passing H₂ gas over heated CuO:

The black coating turns **brown** as copper is reformed. CuO loses oxygen (gets reduced) and H₂ gains oxygen (gets oxidised). This is a **redox reaction**.



(Copper — brown/reddish; Water — colourless)

Source: Chapter 1, Section 1.2.5 (Oxidation and Reduction)

Explanation

- Examiners expect **both** observations (black coating, then brown colour) clearly stated.
- Both **balanced equations with heat arrow** are mandatory for full marks.
- Name and colour of each product must be mentioned — this is a direct instruction in the question.
- Mentioning oxidation/reduction briefly adds value but is not compulsory for 3 marks.

Q42. § 1.1 CHEMICAL EQUATIONS § 1.1.2 Balanced Chemical Equations

[3]

Answer the following:

- (a) Identify the reducing agent in the following reactions : (i) $4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$ (ii) $\text{H}_2\text{O} + \text{F}_2 \rightarrow \text{HF} + \text{HOF}$ (iii) $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ (iv) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
- (b) Define a redox reaction in terms of gain or loss of oxygen.

Previously asked in: 2023 31/1/1 Q27

♦ Chemical Reactions and Equations

Identifying reducing agents in chemical reactions

Redox reactions – definition in terms of gain or loss of oxygen

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Model Answer**(a) Identifying the reducing agent:**

The reducing agent is the substance that **loses oxygen** (or gets oxidised).

- (i) **NH₃** — nitrogen in NH₃ gets oxidised to NO; NH₃ is the reducing agent.
(ii) **H₂O** — oxygen is removed from water; H₂O is the reducing agent.
(iii) **CO** — CO gains oxygen to form CO₂; CO is the reducing agent.
(iv) **H₂** — hydrogen gets oxidised to form H₂O; H₂ is the reducing agent.

(b) Definition of a Redox Reaction:

A reaction in which one substance gets **oxidised** (gains oxygen / loses hydrogen) and another gets **reduced** (loses oxygen / gains hydrogen) simultaneously is called a **redox reaction**.

Example: In $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$, CO is oxidised and Fe₂O₃ is reduced.

Source: Chapter 1, Chemical Reactions and Equations

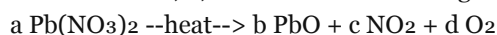
Explanation

- For (a), the reducing agent is always the one that **loses electrons / gets oxidised** — in oxygen-based terms, it is the substance that **gains oxygen** or helps reduce the other substance. Students often confuse reducing agent with the substance being reduced; remember: the **reducing agent itself gets oxidised**.
- For (b), the examiner expects both terms (oxidation and reduction) defined together in one sentence to establish the "redox" concept, with an example.
- Stick to oxygen gain/loss language as the question specifies it.

Q43. § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations

[1]

The values of a, b, c and d in the following balanced chemical equation are respectively :



- A 1, 1, 2, 1
B 1, 1, 1, 2
C 2, 2, 1, 4
D 2, 2, 4, 1

Previously asked in: 2025 31/5/1 Q5

♦ Chemical Reactions and Equations

Balancing chemical equations

Thermal decomposition reactions

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Model Answer**Option D: 2, 2, 4, 1**

The balanced equation is: $2\text{Pb(NO}_3)_2 \xrightarrow{\text{heat}} 2\text{PbO} + 4\text{NO}_2 + 1\text{O}_2$

So a = 2, b = 2, c = 4, d = 1.

Explanation

Balance by checking atoms on both sides: 2 Pb(NO₃)₂ gives 2 Pb, 4 N, 12 O on LHS. RHS: 2 PbO (2 Pb, 2 O) + 4 NO₂ (4 N, 8 O) + 1 O₂ (2 O) = 2 Pb, 4 N, 12 O ✓. Students often confuse c and d; remember NO₂ gets coefficient 4, O₂ gets 1.

Q44. § 1.2.3 Displacement Reaction § 1.3 HAVE YOU OBSERVED THE EFFECTS OF OXIDATION REACTIONS IN EVERYDAY LIFE?

[1]

Assertion (A) : Silver chloride turns grey in sunlight.

Reason (R) : Decomposition of silver chloride into silver and chlorine takes place by sunlight.

- 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: 2025 31/5/1 Q17

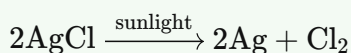
♦ Chemical Reactions and Equations

Photochemical Decomposition Reaction (Silver Chloride in Sunlight)

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Model Answer

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



The silver formed makes AgCl appear grey.

Explanation

This is a **photodecomposition** reaction — sunlight decomposes AgCl into silver (grey) and chlorine gas. The Reason directly explains *why* the grey colour appears (metallic silver deposits), so it is the correct explanation of the Assertion. Students often confuse this with option B; remember, whenever the R logically and directly causes A, choose option A.

Q45. § 1.2.2 Decomposition Reaction**[2]**

A crystalline substance of green colour 'X' emits gases of characteristic odour when heated over a flame. It first loses water and changes colour. On further heating, it decomposes and produces a solid compound Y.

- (a) Identify 'X' and 'Y'.
(b) State the change in colour observed when 'X' is heated.

Previously asked in: 2025 31/5/1 Q21

♦ Chemical Reactions and Equations

Decomposition reactions (thermal)

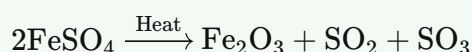
Thermal decomposition of hydrated salts – Copper sulphate / Ferrous sulphate

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Model Answer

(a) 'X' is ferrous sulphate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) and 'Y' is ferric oxide (Fe_2O_3).

The reaction is:



(b) On heating, the green colour of ferrous sulphate crystals first changes to white (on losing water), and then turns reddish-brown (colour of Fe_2O_3) on further heating.

Source: Chapter 1, Section 1.2.2 – Decomposition Reaction

Explanation

- Examiners expect you to name both substances with their chemical formulas and include the balanced equation (it adds precision and earns marks).
- For part (b), mention **two** colour changes: green → white (loss of water) → reddish-brown (Fe_2O_3 formed). Mentioning only one change may cost you a mark.
- The "characteristic odour" in the question refers to SO_2/SO_3 gases — this confirms it is ferrous sulphate decomposing.

Q46. § Chapter Introduction § 1.2 TYPES OF CHEMICAL REACTIONS § 1.2.1 Combination Reaction

[1]

Which of the following is an example of endothermic process ?

- (a) Formation of slaked lime
- (b) Decomposition of vegetable matter into compost
- (c) Dissolution of ammonium chloride in water
- (d) Digestion of food in our body

Previously asked in: 2023 31/2/1 Q1

♦ Chemical Reactions and Equations

Endothermic and Exothermic Reactions

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Model Answer**(c) Dissolution of ammonium chloride in water**

Endothermic reactions absorb energy from the surroundings. Dissolving NH_4Cl in water absorbs heat, making the solution cold — a classic endothermic process.

Explanation

The key definition: **endothermic = energy absorbed**. Options (a), (b), and (d) all release heat (exothermic). Dissolution of NH_4Cl is the standard textbook example of an endothermic process because it cools the surroundings. Examiners expect you to recall this directly from Chapter 1 examples.

Source: Chapter 1, Chemical Reactions and Equations

Q47. § 1.2.2 Decomposition Reaction

[3]

2 g of green coloured crystals of ferrous sulphate are heated in a dry boiling tube. Name the type of chemical reaction taking place. Write the balanced chemical equation for the reaction. Is this an exothermic or an endothermic reaction ?

Previously asked in: 2026 31/3/1 Q26

♦ Chemical Reactions and Equations

Decomposition reactions – endothermic vs exothermic

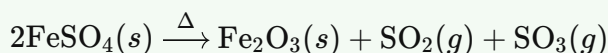
Thermal decomposition of ferrous sulphate

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Model Answer

Type of reaction: Decomposition reaction (thermal decomposition)

Balanced chemical equation:



Ferrous sulphate (green) decomposes on heating to form ferric oxide (reddish-brown), sulphur dioxide and sulphur trioxide gases.

Exothermic or Endothermic: This is an **endothermic reaction** because energy (heat) is absorbed to break down the reactant into simpler products.

Source: Chapter 1, Section 1.2.2 – Decomposition Reaction

Explanation

- **1 mark** for naming the reaction type (thermal decomposition).
- **1 mark** for the correct balanced equation with state symbols.
- **1 mark** for correctly identifying it as endothermic with the reason (energy is absorbed).
- Examiners expect you to state *why* it is endothermic — decomposition reactions require energy input, so they are endothermic.
- Don't forget: the green colour changes to reddish-brown (Fe_2O_3); mentioning this shows observation-based understanding, though not strictly required for marks here.

Q48. § 1.2.3 Displacement Reaction**[1]**

In the following experimental setup of electrolysis of water, if P and Q are the gases collected in the test tubes enclosing the electrodes R and S, then select the option/options in which the matching is correct :

- (i) P – Oxygen gas , R – Anode
- (ii) P – Hydrogen gas , R – Cathode
- (iii) Q – Hydrogen gas , S – Cathode
- (iv) Q – Oxygen gas , S – Anode

- (A) (i) and (ii)
- (B) (iii) and (iv)
- (C) (i) and (iii)
- (D) (ii) and (iv)

Previously asked in: 2025 31/6/1 Q1

♦ Chemical Reactions and Equations

Decomposition Reaction

Electrolysis of Water

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Model Answer**(D) (ii) and (iv)**

In electrolysis of water, hydrogen gas (double the volume) collects at the cathode and oxygen at the anode. From the diagram, P (left, more gas) is hydrogen → R is cathode; Q (right, less gas) is oxygen → S is anode. So (ii) and (iv) are correct.

Explanation

- At cathode: $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$; at anode: $2\text{OH}^- \rightarrow \text{H}_2\text{O} + \frac{1}{2}\text{O}_2$. Hydrogen is produced in double the volume of oxygen.
- The test tube with **more** gas (P, left = R) collects $\text{H}_2 \rightarrow$ R is cathode. The test tube with **less** gas (Q, right = S) collects $\text{O}_2 \rightarrow$ S is anode.
- Statement (i) wrongly calls P oxygen; statement (iii) wrongly calls Q hydrogen. Only (ii) and (iv) are correct → Option **(D)**.

Q49. § 1.2 TYPES OF CHEMICAL REACTIONS § 1.3 HAVE YOU OBSERVED THE EFFECTS OF OXIDATION REACTIONS IN EVERYDAY LIFE? [3]

Silver chloride kept in a china dish turns grey in sunlight.

- (a) Write the colour of silver chloride when it was kept in the china dish.
- (b) Name the type of chemical reaction taking place and write the chemical equation for the reaction.
- (c) State one use of the reaction. Name one more chemical which can be used for the same purpose.

Previously asked in: 2023 31/2/1 Q27

♦ Chemical Reactions and Equations

Applications of Decomposition Reactions (Black and White Photography)

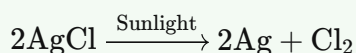
Decomposition Reactions

Photodecomposition (Photolytic Decomposition) Reaction

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Model Answer

- (a) Silver chloride is **white** in colour when kept in the china dish.
- (b) It is a **photochemical decomposition reaction** (decomposition by light).



Silver chloride decomposes into silver (grey) and chlorine gas in the presence of sunlight.

- (c) This reaction is used in **black and white photography**. Silver bromide (AgBr) is another chemical that can be used for the same purpose.

Source: Chapter 1, Chemical Reactions and Equations

Explanation

- (a) is 1 mark — just state the colour: white.
- (b) is 1 mark — name the reaction type correctly (photochemical decomposition) and write the balanced equation. Examiners look for the sunlight condition written above the arrow.
- (c) is 1 mark — state the use (photography) and name one more chemical (AgBr). Both parts must be present for full credit.
- The grey colour appears because silver metal (Ag) is formed, which is grey — useful to mention briefly.

Q50. § 1.2 TYPES OF CHEMICAL REACTIONS**[1]**

Assertion (A) : Decomposition reactions are generally endothermic reactions.

Reason (R) : Decomposition of organic matter into compost is an exothermic process.

- (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 31/1/1 Q17

♦ Chemical Reactions and Equations

Decomposition Reactions – Endothermic Nature

Exothermic and Endothermic Reactions

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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).

Decomposition reactions generally require energy input, making them endothermic. Decomposition of organic matter into compost is indeed exothermic, but this does not explain why decomposition reactions are endothermic.

Explanation

- **A is true:** Most decomposition reactions (thermal, electrolytic, photolytic) require energy — they are endothermic.
- **R is true:** Composting (biological decomposition) releases heat — it is exothermic.
- **R does NOT explain A:** In fact, composting is an *exception* to the general rule stated in A. A reason that contradicts or is unrelated to the assertion cannot be its correct explanation, so option **(B)** is correct, not (A).
- Key examiner tip: Always check whether R logically *supports and explains* A, not merely whether both statements are independently true.

Q51. § 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 = Al₂O₃ ; 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: $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$. 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.

Q52. § 1.2.1 Combination Reaction

[1]

Assertion (A) : Reaction of Quicklime with water is an exothermic reaction.

Reason (R) : Quicklime reacts vigorously with water releasing a large amount of heat.

- (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: 2023 31/4/1 Q17

♦ Chemical Reactions and Equations

Exothermic Reactions – Quicklime reacting with water

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Model Answer

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

Quicklime (CaO) reacts vigorously with water releasing a large amount of heat, making it an exothermic reaction. (R) directly explains why (A) is true.

Source: Chapter 1, Section 1.2.1 Combination Reaction

Explanation

The textbook explicitly states: "*Calcium oxide reacts vigorously with water to produce slaked lime releasing a large amount of heat*" and defines exothermic reactions as those in which heat is released along with products. Since (R) gives the exact reason for (A), option (a) is correct — not (b). Students often confuse (a) and (b); choose (b) only when the reason, though true, explains something else.

Q53. § 1.2 TYPES OF CHEMICAL REACTIONS § 1.2.1 Combination Reaction § 1.2.2 Decomposition Reaction

[1]

Select from the following a decomposition reaction in which source of energy for decomposition is light :

- (a) $2\text{FeSO}_4 \rightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$
- (b) $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
- (c) $2\text{AgBr} \rightarrow 2\text{Ag} + \text{Br}_2$
- (d) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$

Previously asked in: 2024 31/1/1 Q2

♦ Chemical Reactions and Equations

Photolytic Decomposition Reaction

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Model Answer**(c) $2\text{AgBr} \rightarrow 2\text{Ag} + \text{Br}_2$**

This is a photochemical decomposition reaction where silver bromide decomposes in the presence of sunlight (light energy) to form silver and bromine.

Explanation

- Option (a) uses heat; option (b) uses electricity; option (d) uses heat — all are thermal decomposition reactions.
- $2\text{AgBr} \rightarrow 2\text{Ag} + \text{Br}_2$ is a classic **photochemical decomposition** (light as energy source), used as the standard textbook example.
- Examiners expect students to distinguish between heat, light, and electricity as energy sources in decomposition reactions (as asked in Exercise Q.12 of Chapter 1).

Q54. § 1.2.2 Decomposition Reaction

[1]

The gases evolved on heating lead (II) nitrate crystals are :

- A NO and O_2
- B N_2 and NO_2
- C NO_2 and H_2
- D NO_2 and O_2

Previously asked in: 2026 31/1/1 Q19

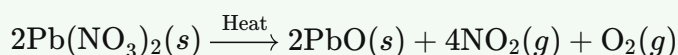
♦ Chemical Reactions and Equations

Thermal decomposition reactions

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Model Answer

The correct answer is **D — NO_2 and O_2** .



Heating lead(II) nitrate produces brown fumes of nitrogen dioxide and oxygen gas.

Source: Chapter 1, Section 1.2.2 (Activity 1.6)

Explanation

The textbook explicitly states that brown fumes observed on heating lead nitrate are of NO_2 , and the balanced equation (1.21) shows the two gases produced are NO_2 and O_2 . Examiners expect you to recall this specific reaction. Note that no hydrogen is involved, ruling out options C; N_2 is not a product, ruling out B; and NO alone is not produced, ruling out A.

Q55. § 1.1 CHEMICAL EQUATIONS § 1.2.1 Combination Reaction § 1.2.4 Double Displacement Reaction

[3]

Answer the following:

(i) While electrolysis of water before passing the current some drops of an acid are added. Why? Name the gases liberated at cathode and anode. Write the relationship between the volume of gas collected at anode and the volume of gas collected at cathode.

(ii) What is observed when silver chloride is exposed to sunlight? Give the type of reaction involved.

Previously asked in: 2023 31/4/1 Q27

♦ Chemical Reactions and Equations

Electrolysis of water – role of acid, gases at cathode and anode, volume relationship

Photochemical decomposition – decomposition of silver chloride in sunlight

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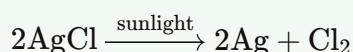
Model Answer

(i) A few drops of acid (dilute H_2SO_4) are added to water to make it a good conductor of electricity (pure water is a poor conductor).

- Gas liberated at **cathode**: Hydrogen (H_2)
- Gas liberated at **anode**: Oxygen (O_2)

Relationship: Volume of H_2 at cathode : Volume of O_2 at anode = **2 : 1**

(ii) When silver chloride (AgCl) is exposed to sunlight, it turns **grey** due to decomposition into silver (Ag) and chlorine (Cl_2).



Type of reaction: **Photochemical decomposition reaction.**

Explanation

- In part (i), examiners expect three things: reason for adding acid, names of gases at each electrode, and the 2:1 volume ratio. Missing any one costs a mark.
- In part (ii), state the observable change (white → grey), write the balanced equation, and name the reaction type. "Photochemical decomposition" is the exact term expected — just "decomposition" may not fetch full credit.

Q56. § 1.1 CHEMICAL EQUATIONS § 1.2 TYPES OF CHEMICAL REACTIONS § 1.2.2 Decomposition Reaction

[1]

Answer the following : Give one example each of electrolytic decomposition and decomposition by sunlight.

Previously asked in: 2026 31/1/1 Q26 (c)

♦ Chemical Reactions and Equations

Decomposition reactions (electrolytic and photolytic/by sunlight)

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Model Answer

Electrolytic decomposition: $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$ (electrolysis of water).

Decomposition by sunlight: $2\text{AgCl} \rightarrow 2\text{Ag} + \text{Cl}_2$ (silver chloride decomposes in sunlight).

Explanation

Examiners expect one clear example of each type with a chemical equation. Electrolysis of water is the standard textbook example of electrolytic decomposition; decomposition of AgCl (or AgBr) in sunlight is the standard example of photolytic decomposition. Both are from Chapter 1 of the CBSE Science textbook.

Q57. § 1.2.1 Combination Reaction

[2]

Name the type of chemical reaction in which calcium oxide reacts with water. Justify your answer by giving balanced chemical equation for the chemical reaction.

Previously asked in: 2024 31/1/1 Q21

♦ Chemical Reactions and Equations

Balanced Chemical Equations

Combination Reaction – CaO reacting with water

Exothermic Reactions

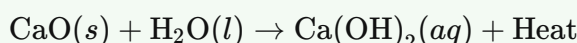
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Model Answer

The reaction between calcium oxide and water is a **combination reaction** (also exothermic).

Justification: Two reactants (CaO and H₂O) combine to form a single product (calcium hydroxide). A reaction in which two or more substances combine to form a single product is called a combination reaction.

Balanced chemical equation:



Source: Chapter 1, Section 1.2.1 Combination Reaction

Explanation

- **1 mark** for correctly naming the reaction type (combination reaction).
- **1 mark** for the balanced equation with correct formulae and state symbols.
- Always write state symbols — (s), (l), (aq) — as they show you understand the reaction fully.
- You may also mention it is exothermic (heat is released), but the primary answer required is "combination reaction."

Q58. § 1.1 CHEMICAL EQUATIONS § 1.1.1 Writing a Chemical Equation § 1.2.4 Double Displacement Reaction**[3]**

Write one chemical equation each for the chemical reaction in which the following have taken place : Mention colour change/temperature change (rise/fall)/compound precipitated along with equation.

- (i) Change in colour
- (ii) Change in temperature
- (iii) Formation of precipitate

Previously asked in: 2024 31/1/1 Q27

♦ Chemical Reactions and Equations

Colour change in chemical reactions

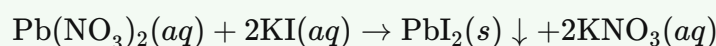
Formation of precipitate in chemical reactions

Temperature change (exothermic/endothermic) in chemical reactions

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Model Answer**(i) Change in colour:**

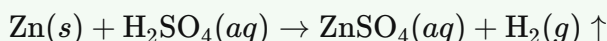
When lead nitrate solution is added to potassium iodide solution, a yellow precipitate of lead iodide is formed.



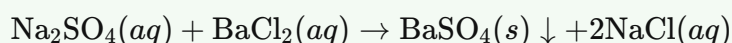
(Yellow precipitate of PbI_2 formed)

(ii) Change in temperature:

When zinc granules react with dilute sulphuric acid, hydrogen gas is evolved and temperature of the flask **rises** (exothermic reaction).

**(iii) Formation of precipitate:**

When sodium sulphate solution is mixed with barium chloride solution, a white precipitate of barium sulphate is formed.



(White precipitate of BaSO_4 formed)

Source: Chemical Reactions and Equations, Chapter 1 (Activities 1.2, 1.3, 1.10)

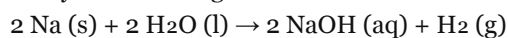
Explanation

- Each sub-question carries 1 mark: one equation with the observation stated is sufficient.
- Always mention the colour change / temperature change / precipitate colour alongside the equation — examiners award the mark for the observation too, not just the equation.
- Use state symbols (aq), (s), (g) and ↓ or ↑ arrows where applicable; these show precision.
- The $\text{Pb}(\text{NO}_3)_2 + \text{KI}$ reaction is the standard textbook example for colour change (yellow PbI_2); $\text{Zn} + \text{H}_2\text{SO}_4$ for temperature rise; $\text{Na}_2\text{SO}_4 + \text{BaCl}_2$ for white precipitate.

Q59. § 1.1.2 Balanced Chemical Equations § 1.2.1 Combination Reaction § 1.2.4 Double Displacement Reaction

[1]

Study the following chemical reaction :



The reducing agent in this reaction is :

- (a) Na
- (b) H₂O
- (c) NaOH
- (d) H₂

Previously asked in: 2023 31/5/1 Q3

♦ Chemical Reactions and Equations

Oxidation and Reduction – Identifying Reducing Agent in a Redox Reaction

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Model Answer**(a) Na**

Na is the reducing agent because it loses electrons (gets oxidised from 0 to +1), thereby reducing hydrogen in water from +1 to 0 (H₂).

Explanation

The reducing agent is the substance that **itself gets oxidised** (loses electrons) and causes reduction in another substance. Here, Na goes from oxidation state 0 → +1 (oxidised), so Na is the reducing agent. H₂O is the oxidising agent (hydrogen in it is reduced from +1 → 0). Examiners expect you to identify the correct substance and briefly justify using oxidation states or electron transfer.

Q60. § 1.2 TYPES OF CHEMICAL REACTIONS

[3]

Answer the following:

- (a) (i) Define the term decomposition reaction. Write one chemical equation each for decomposition reaction where energy is supplied in the form of heat, light or electricity. (ii) Decomposition of vegetable matter into compost is considered an exothermic reaction. Why ? [3]

Previously asked in: 2025 31/2/1 Q27

♦ Chemical Reactions and Equations

Decomposition Reactions (thermal, photolytic, electrolytic)

Exothermic and Endothermic Reactions

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Model Answer

(a)(i) A reaction in which a single reactant breaks down to give two or more products is called a **decomposition reaction**.

- **Heat:** $2\text{FeSO}_4 \xrightarrow{\Delta} \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$
- **Light:** $2\text{AgCl} \xrightarrow{\text{sunlight}} 2\text{Ag} + \text{Cl}_2$
- **Electricity:** $2\text{H}_2\text{O} \xrightarrow{\text{electric current}} 2\text{H}_2 + \text{O}_2$

(a)(ii) During decomposition of vegetable matter, microorganisms break down complex organic substances. This process releases heat energy into the surroundings, making it an exothermic reaction.

Source: Chapter 1, Chemical Reactions and Equations

Explanation

- The definition must include: one reactant → two or more products.
- Give **one equation each** for heat, light, and electricity — all three are required.
- For part (ii), the key point is that energy (heat) is **released** during the process, which is the defining characteristic of an exothermic reaction. Examiners look for the word "released" or "given out."

Q61. § 1.2.1 Combination Reaction

[1]

Solid Calcium oxide reacts vigorously with water to form Calcium hydroxide accompanied by the liberation of heat. From the information given above it may be concluded that this reaction

- (A) is endothermic and pH of the solution formed is more than 7.
- (B) is exothermic and pH of the solution formed is 7.
- (C) is endothermic and pH of the solution formed is 7.
- (D) is exothermic and pH of the solution formed is more than 7.

Previously asked in: 2024 31/2/1 Q1

♦ Chemical Reactions and Equations

Combination Reactions

Exothermic Reactions

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Model Answer

(D) is exothermic and pH of the solution formed is more than 7.

Heat is liberated → exothermic. Ca(OH)_2 is a base → its solution is alkaline → $\text{pH} > 7$.

Explanation

Two facts decide the answer: (1) heat is released = exothermic (not endothermic), eliminating A and C; (2) Ca(OH)_2 is a base, so its aqueous solution is alkaline with $\text{pH} > 7$ (not = 7), eliminating B. Both conditions together point to option D.

Q62. § 1.2.1 Combination Reaction

[1]

Select from the following a process in which a combination reaction is involved :

- (A) Black and White photography
- (B) Burning of coal
- (C) Burning of methane
- (D) Digestion of food

Previously asked in: 2024 31/2/1 Q3

♦ Chemical Reactions and Equations

Combination Reactions

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Model Answer

(B) Burning of coal

In burning of coal: $\text{C}(s) + \text{O}_2(g) \rightarrow \text{CO}_2(g)$, two reactants combine to form a single product — this is a combination reaction.

Source: Chapter 1, Section 1.2.1

Explanation

The textbook explicitly lists "burning of coal" as an example of a combination reaction (equation 1.15). Burning of methane (option C) is listed as an exothermic reaction, not combination. Digestion of food is decomposition/exothermic. Black and white photography involves decomposition of silver salts. Examiners expect you to recall that combination = two or more reactants → one single product.

Q63. § Chapter Introduction § 1.1 CHEMICAL EQUATIONS § 1.2 TYPES OF CHEMICAL REACTIONS

[2]

List the possible sources of energy required in decomposition reactions. Illustrate any one with a suitable example.

Previously asked in: 2025 31/3/1 Q21(a)

♦ Chemical Reactions and Equations

Decomposition Reactions – Sources of Energy (Thermal, Light, Electrical)

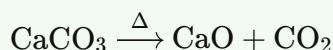
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Model Answer

The possible sources of energy for decomposition reactions are:

1. **Heat** (thermal decomposition)
2. **Light** (photochemical decomposition)
3. **Electricity** (electrolytic decomposition)

Example (Heat): When calcium carbonate is heated, it decomposes to form calcium oxide and carbon dioxide:



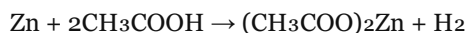
Source: Chapter 1, Chemical Reactions and Equations

Explanation

- The question has two parts: list sources (1 mark) and illustrate one with an example (1 mark). Name all three sources for full credit on the listing part.
- Any one correct example with a balanced equation earns the illustration mark — e.g., electrolysis of water or decomposition of silver chloride in sunlight are equally acceptable.
- Write the condition (heat symbol Δ , or "sunlight," or "electricity") above the arrow — examiners check for this.

Q64. § 1.1.2 Balanced Chemical Equations

[1]



The above reaction is a :

- A Decomposition reaction
- B Displacement reaction
- C Double displacement reaction
- D Combination reaction

Previously asked in: 2024 31/4/1 Q1

♦ Chemical Reactions and Equations

Types of Chemical Reactions – Displacement Reaction

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Model Answer

The correct answer is **(B) Displacement reaction**.

In this reaction, zinc (a more reactive metal) displaces hydrogen from acetic acid, which is a characteristic of displacement reactions.

Explanation

In a displacement reaction, a more reactive element displaces a less reactive element from its compound. Here, Zn displaces H₂ from CH₃COOH. This is analogous to $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$ discussed in Chapter 1. Do not confuse it with double displacement, where two compounds exchange ions with each other.

Source: Chapter 1, Chemical Reactions and Equations

Q65. § 1.1 CHEMICAL EQUATIONS

[2]

When magnesium ribbon is burnt in air, an ash of white colour is produced. Write chemical equation for the reaction giving the chemical name of the ash produced. State the type of chemical reaction giving justification for your answer.

Previously asked in: 2024 31/3/1 Q21

♦ Chemical Reactions and Equations

Combustion reaction of magnesium in air

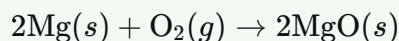
Types of chemical reactions – combination and oxidation

Writing and balancing chemical equations

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Model Answer

Chemical equation:



The white ash formed is **magnesium oxide**.

Type of reaction: It is a **combination reaction** because two reactants (magnesium and oxygen) combine to form a single product (magnesium oxide). It is also an **oxidation reaction** as magnesium gains oxygen.

Source: Chapter 1, Section 1.1; Chapter 3, Section 3.2.1

Explanation

- The question asks for **three things**: the equation, the name of the ash, and the type of reaction with justification — address all three.
- The balanced equation must show **2Mg** on the left to balance atoms (skeletal equation $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$ is unbalanced).
- Examiners accept **combination reaction** as the primary answer; mentioning oxidation as an additional point can fetch bonus credit or shows completeness.
- "Justification" means you must state *why* it is a combination reaction — always include the one-line reason.

Q66. § 1.2.1 Combination Reaction

[1]

Assertion (A) : Reaction of quick lime with water is an exothermic reaction.

Reason (R) : A large amount of heat is evolved on the reaction of quick lime and water.

- (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: 2026 31/5/1 Q24

♦ Chemical Reactions and Equations

Exothermic Reactions

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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).

$\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2 + \text{Heat}$. Since a large amount of heat is evolved, it is an exothermic reaction, and R directly explains A.

Explanation

The textbook explicitly states that CaO reacts vigorously with water releasing a large amount of heat, and that reactions releasing heat are called exothermic reactions. So both A and R are true, and R is the **direct** cause/explanation of A — making option (A) correct. Do not confuse this with option (B); R here is not just a coincidental true statement but the actual reason why the reaction is exothermic.

Q67. § 1.1.2 Balanced Chemical Equations § 1.2.2 Decomposition Reaction § 1.2.3 Displacement Reaction

[3]

What happens when

(i) lead (II) nitrate is heated ?

(ii) iron (II) sulphate is heated ?

(iii) silver chloride is exposed to sunlight ?

Write balanced chemical equations of the reactions involved in support of your answer.

Previously asked in: 2026 31/5/1 Q26

♦ Chemical Reactions and Equations

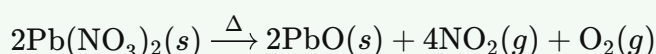
Balanced chemical equations for decomposition reactions

Decomposition reactions (thermal and photolytic decomposition)

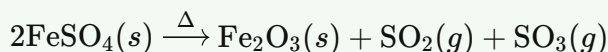
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Model Answer

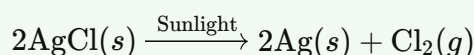
(i) Lead (II) nitrate on heating decomposes to give lead monoxide, nitrogen dioxide (brown fumes) and oxygen. It is a thermal decomposition reaction.



(ii) Iron (II) sulphate on heating decomposes to give iron (III) oxide, sulphur dioxide and sulphur trioxide.



(iii) Silver chloride on exposure to sunlight decomposes to give silver metal and chlorine gas. The white silver chloride turns grey. It is a photochemical decomposition reaction.



All three are **decomposition reactions**.

Source: Chemical Reactions and Equations, Chapter 1

Explanation

- All three are examples of **decomposition reactions** — thermal decomposition for (i) and (ii), photochemical decomposition for (iii). Examiners expect you to state *what is observed* (brown fumes, grey colour, etc.) and write a correct balanced equation for each. Identifying the type of reaction (decomposition) adds value and may fetch bonus credit.
- The brown fumes of NO_2 in (i) are a key observable fact to mention.
- For (iii), stating the colour change (white $\rightarrow$ grey) demonstrates understanding.

Q68.

[1]

The volume ratio of hydrogen and oxygen gases liberated during electrolysis of water is

- (A) 1 : 1
- (B) 2 : 1
- (C) 4 : 1
- (D) 1 : 2

Previously asked in: 2026 31/4/1 Q17; 2026 31/5/1 Q17 — 2×

♦ Chemical Reactions and Equations

Electrolysis of Water (Decomposition Reaction)

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Model Answer**(B) 2 : 1**

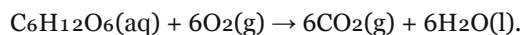
During electrolysis of water, hydrogen is liberated at the cathode and oxygen at the anode in the volume ratio of **2 : 1**, as water molecule contains two hydrogen atoms for every one oxygen atom.

Explanation

The chemical equation for electrolysis of water is: $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$. Since 2 volumes of H_2 are produced for every 1 volume of O_2 , the ratio is 2:1. Note: the source passages provided do not directly cover this topic, but the answer is based on standard Class 10 Chemistry (Chapter 1 — Chemical Reactions and Equations / practical knowledge). Examiners expect students to recall this fact directly.

Q69. § 1.1 CHEMICAL EQUATIONS § 1.2.1 Combination Reaction § 1.2.4 Double Displacement Reaction

[1]



The above reaction is an example of

- (A) Displacement Reaction
- (B) Endothermic Reaction
- (C) Exothermic Reaction
- (D) Neutralisation Reaction

Previously asked in: 2026 31/4/1 Q18

♦ Chemical Reactions and Equations

Exothermic Reaction

Oxidation / Combustion Reaction

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Model Answer

(C) Exothermic Reaction

The given reaction is respiration, where glucose burns in oxygen releasing energy (heat). Reactions that release heat along with products are called exothermic reactions.

Source: Chapter 1, What you have learnt; Chapter 1, Exercise Q.10

Explanation

- The key clue is that glucose reacts with oxygen to produce CO_2 and H_2O — this is cellular respiration, which **releases energy**, making it exothermic.
- Examiners expect you to recall that **exothermic = heat released**; endothermic = heat absorbed.
- It is **not** displacement (no element replacing another) or neutralisation (no acid-base), so eliminate those quickly.
- NCERT Exercise Q.10 directly asks why respiration is exothermic — link that knowledge here.

Q70. § Chapter Introduction § 1.2 TYPES OF CHEMICAL REACTIONS

[5]

What is a chemical reaction ? Describe one activity each to show that a chemical change has occurred in which (i) change of colour, and (ii) change in temperature has taken place.

Previously asked in: 2024 31/4/1 Q34 (a)

♦ Chemical Reactions and Equations

Definition of a Chemical Reaction

Indicators of a Chemical Change – Change in Temperature

Indicators of a Chemical Change – Change of Colour

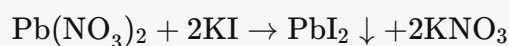
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Model Answer

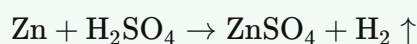
Chemical Reaction: A chemical reaction is a process in which one or more substances (reactants) are transformed into new substances (products) with different properties. It involves breaking and making of bonds between atoms.

(i) Change of Colour:

Take lead nitrate solution in a test tube and add potassium iodide solution to it. A bright yellow precipitate of lead iodide is formed immediately. The change in colour (from colourless to yellow) indicates that a chemical reaction has taken place.

**(ii) Change in Temperature:**

Take zinc granules in a conical flask and add dilute sulphuric acid. Bubbles of hydrogen gas are produced and the flask becomes warm on touching. The rise in temperature shows that a chemical (exothermic) reaction has taken place.



Source: Chapter 1, Chemical Reactions and Equations, Activities 1.2 and 1.3

Explanation

- Define chemical reaction in 1–2 lines first (1 mark).
- Each activity is worth ~2 marks: name substances used, state the observation clearly, and write the equation.
- Examiners look for: correct activity description, the specific observation (colour change / temperature change), and the chemical equation.
- Use Activity 1.2 (lead nitrate + potassium iodide → yellow precipitate) for colour change and Activity 1.3 (Zn + H₂SO₄, flask becomes warm) for temperature change — these are the textbook examples.

Q71. § 1.2.3 Displacement Reaction § 1.3 HAVE YOU OBSERVED THE EFFECTS OF OXIDATION REACTIONS IN EVERYDAY LIFE?**[1]**

Account for the following : White silver chloride turns grey when exposed to sunlight.

Previously asked in: 2026 31/4/1 Q26 (a)

♦ Chemical Reactions and Equations

Decomposition Reaction (Photolysis of Silver Chloride)

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Model Answer

Silver chloride (AgCl) is decomposed by sunlight into silver (grey) and chlorine gas. This is a photochemical decomposition reaction: $2AgCl \xrightarrow{\text{sunlight}} 2Ag + Cl_2 \uparrow$

Explanation

The examiner expects you to name the type of reaction (photochemical decomposition) and give the equation. The product silver (Ag) is grey, which explains the colour change. This is a standard example of a decomposition reaction triggered by light, not heat.

Q72. § 1.2.2 Decomposition Reaction**[1]**

Account for the following : Lead (II) nitrate on heating releases brown fumes.

Previously asked in: 2026 31/4/1 Q26 (b)

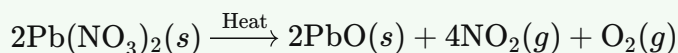
♦ Chemical Reactions and Equations

Thermal Decomposition Reaction

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Model Answer

When lead(II) nitrate is heated, it undergoes thermal decomposition to form lead oxide, nitrogen dioxide, and oxygen. The brown fumes are of nitrogen dioxide (NO₂).



Source: Chapter 1, Section 1.2.2 Decomposition Reaction

Explanation

The examiner expects: (1) identification of the brown fumes as NO₂, and (2) the balanced equation. For 1 mark, either naming NO₂ with a brief reason **or** writing the equation is sufficient, but including both makes the answer complete and safe.

Q73. § 1.1 CHEMICAL EQUATIONS § 1.2.3 Displacement Reaction § 1.2.5 Oxidation and Reduction

[3]

Attempt either option (A) or (B). Option (A):

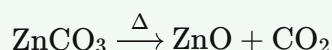
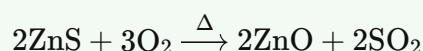
- (i) Which method will be used to convert each of them to their respective metal oxides ? (a) Carbonate ore (b) Sulphide ore
- (ii) Write a chemical reaction to illustrate the use of aluminium for joining cracked railway tracks.
- (iii) During extraction of metals, electrolytic refining is used to obtain pure metals. Which material will be used as anode and cathode for the refining of copper metal by this process ?

Previously asked in: 2026 31/4/1 Q27 (A)

♦ Chemical Reactions and Equations

Thermal Decomposition Reaction

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Model Answer**(i)**(a) **Carbonate ore** → **Calcination** (heating in absence of air)(b) **Sulphide ore** → **Roasting** (heating in excess of air)**(ii)** Aluminium is used in the **thermite reaction** to join cracked railway tracks:

The large amount of heat produced melts iron, which joins the tracks.

(iii) For electrolytic refining of copper:

- **Anode** → Impure copper (thick block)
- **Cathode** → Pure copper (thin strip)
- **Electrolyte** → Copper sulphate (CuSO_4) solution

Source: Metals and Non-metals, Sections on Extraction of Metals and Electrolytic Refining

Explanation

- (i) is the key distinction: **calcination** = carbonate ores, **roasting** = sulphide ores. Examiners expect the correct term + equation.
- (ii) The thermite reaction equation must be balanced and written exactly; the mention of heat/joining is expected.
- (iii) Remember: anode = impure metal, cathode = pure metal — this is a frequently tested fact. The electrolyte (CuSO_4 solution) is often missed; include it.

Q74. § 1.2 TYPES OF CHEMICAL REACTIONS § 1.2.1 Combination Reaction

[5]

- (i) Define a decomposition reaction. How can we say that (I) electrolysis of water, and (II) blackening of silver bromide when exposed to sunlight, are decomposition reactions? Mention the type of energy involved in each case.
- (ii) The type of reactions in which (I) calcium oxide is formed, and (II) calcium hydroxide is formed are opposite reactions to each other. Justify this statement with the help of chemical equations.

Previously asked in: 2024 31/4/1 Q34 (b)

♦ Chemical Reactions and Equations

Combination vs Decomposition reactions – CaO and Ca(OH)₂ as opposite reactions

Decomposition Reactions – definition and types (thermal, electrolytic, photolytic)

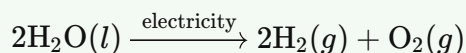
Electrolysis of water as an electrolytic decomposition reaction

Photolytic decomposition – blackening of silver bromide in sunlight

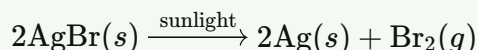
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Model Answer

(i) Decomposition Reaction: A reaction in which a single substance breaks down to give two or more substances is called a decomposition reaction.

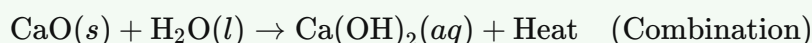
I. Electrolysis of water:

Water (one substance) decomposes into hydrogen and oxygen. Hence it is a decomposition reaction. Energy involved: **electrical energy**.

II. Blackening of silver bromide:

Silver bromide decomposes into silver and bromine. Hence it is a decomposition reaction. Energy involved: **light energy**.

(ii) Formation of calcium oxide involves **decomposition** ($\text{CaCO}_3 \xrightarrow{\Delta} \text{CaO} + \text{CO}_2$), while formation of calcium hydroxide involves **combination** ($\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$). These are opposite reactions:



In decomposition, one reactant splits into two products; in combination, two reactants form one product — hence they are opposite reactions.

Source: Chapter 1, Section 1.2 — Types of Chemical Reactions

Explanation

- Part (i):** Always write the definition, then the equation, then explicitly state *why* it is a decomposition reaction (one substance → two or more), and name the type of energy. Examiners award separate marks for the equation, the reasoning, and the energy type.
- Part (ii):** The key is identifying that CaO is formed by *decomposition* of CaCO₃, and Ca(OH)₂ is formed by *combination* of CaO and H₂O. Writing both equations and labelling them is essential. The word "opposite" must be justified — decomposition splits, combination merges.

- Keep equations balanced; unbalanced equations lose marks.

Q75. § 1.2.3 Displacement Reaction**[1]**

Assertion (A) : The colour of aqueous solution of copper sulphate turns colourless when a piece of lead is added to it.

Reason (R) : Lead is more reactive than copper, and hence displaces copper from its salt solution.

- (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: 2023 31/1/1 Q17

♦ Chemical Reactions and Equations

Assertion-Reason: Colour Change in Displacement Reactions

Displacement Reactions and Reactivity Series

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Model Answer

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

Lead is more reactive than copper and displaces copper from copper sulphate solution, turning the blue solution colourless: $\text{Pb} + \text{CuSO}_4 \rightarrow \text{PbSO}_4 + \text{Cu}$.

Explanation

The textbook (equation 1.26) shows Pb displacing Cu from CuCl_2 ; it also states "Zinc and lead are more reactive than copper." The same logic applies to CuSO_4 — lead displaces copper, removing the Cu^{2+} ions responsible for the blue colour, making the solution colourless. So both A and R are true, and R correctly explains A. Option (a) is correct.

Q76. § 1.1 CHEMICAL EQUATIONS § 1.2 TYPES OF CHEMICAL REACTIONS § 1.2.3 Displacement Reaction

[3]

Study the experimental set-up shown in the diagram and write chemical equation for the chemical reaction involved. Name and define the type of reaction. List two other metals which can be used in place of iron to show the same type of reaction with copper sulphate solution.

Previously asked in: 2024 31/5/1 Q27

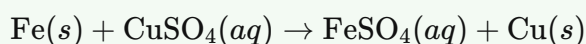
♦ Chemical Reactions and Equations

Chemical Equation for Iron and Copper Sulphate Reaction

Displacement Reaction

Reactivity Series and Metal Displacement

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Model Answer**Chemical Equation:****Type of Reaction:** Displacement reaction.**Definition:** A reaction in which a more reactive element displaces a less reactive element from its compound (in solution or molten form) is called a displacement reaction.**Two other metals** that can displace copper from copper sulphate solution:

1. Zinc (Zn)
2. Lead (Pb)

(Both are more reactive than copper, so they displace it from CuSO₄ solution.)

Source: Chapter 1, Section 1.2.3; Chapter 3, Section 3.2.4

Explanation

- The equation must include state symbols — examiners award marks for these.
- Name **and** define the reaction type — both are needed for full marks; just naming it is not enough.
- The two metals must be **more reactive than copper** (above Cu in the activity series). Zinc and lead are the safest choices as the textbook explicitly lists them as examples (equations 1.25 and 1.26). Magnesium, aluminium, iron (already used) also work, but zinc and lead are directly cited for this reaction.
- Do not write metals less reactive than copper (e.g., silver, gold) — they cannot displace copper.

Q77. § 1.2 TYPES OF CHEMICAL REACTIONS § 1.2.4 Double Displacement Reaction

[1]

Which of the following is an example of a displacement reaction ?

- (A) The combustion of natural gas
- (B) The reaction of a reactive metal with dilute acid
- (C) The electrolysis of water
- (D) The reaction of quick lime with water

Previously asked in: 2026 31/3/1 Q17

♦ Chemical Reactions and Equations

Displacement Reactions

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Model Answer

(B) The reaction of a reactive metal with dilute acid

For example: $\text{Fe} + \text{H}_2\text{SO}_4 \rightarrow \text{FeSO}_4 + \text{H}_2 \uparrow$ — the metal displaces hydrogen from the acid.

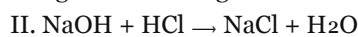
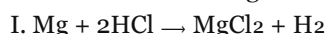
Explanation

A displacement reaction occurs when a more reactive element displaces a less reactive element from its compound. In option (B), a reactive metal displaces hydrogen from the acid. Option (A) is a combination/combustion reaction, (C) is decomposition, and (D) is also a combination reaction. Examiners expect you to identify the correct type and may award the mark only for (B).

Q78. § 1.1 CHEMICAL EQUATIONS § 1.1.1 Writing a Chemical Equation § 1.2.4 Double Displacement Reaction

[1]

Consider the following chemical equation I and II



The correct statement about these equations is —

- (a) 'I' is a displacement reaction and 'II' is a decomposition reaction.
- (b) 'I' is a displacement reaction and 'II' is double displacement reaction.
- (c) Both 'I' and 'II' are displacement reactions.
- (d) Both 'I' and 'II' are double-displacement reactions.

Previously asked in: 2023 31/6/1 Q12

♦ Chemical Reactions and Equations

Displacement Reactions

Double displacement and precipitation reactions

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Model Answer

(b) 'I' is a displacement reaction and 'II' is a double displacement reaction.

In equation I, Mg displaces H from HCl (single displacement). In equation II, Na^+ and H^+ exchange partners — a double displacement (neutralisation) reaction.

Explanation

- **Displacement reaction:** One element displaces another from a compound. Here, Mg displaces H_2 from HCl.
- **Double displacement reaction:** Ions of two compounds exchange places. In $\text{NaOH} + \text{HCl}$, Na^+ pairs with Cl^- and H^+ pairs with OH^- to form water — classic neutralisation = double displacement.
- **Common mistake:** Students label II as "neutralisation only" and forget neutralisation is a *type* of double displacement reaction.

Q79. § 1.1 CHEMICAL EQUATIONS § 1.1.1 Writing a Chemical Equation § 1.1.2 Balanced Chemical Equations

[2]

State whether the given chemical reaction is a redox reaction or not. Justify your answer.



Previously asked in: 2023 31/6/1 Q21

♦ Chemical Reactions and Equations

Redox Reactions (Oxidation and Reduction)

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Model Answer

Yes, — it is a redox reaction.

In this reaction, Mn in MnO_2 goes from +4 to +2 oxidation state (gains electrons → **reduction**), while Cl in HCl goes from –1 to 0 in Cl_2 (loses electrons → **oxidation**). Since both oxidation and reduction occur simultaneously, it is a **redox reaction**.

Explanation

- A redox reaction must show **both** oxidation and reduction occurring simultaneously — mention both clearly for full marks.
- Assign oxidation states to Mn (+4 → +2) and Cl (–1 → 0) to justify your answer; this is what examiners look for.
- The textbook defines oxidation as gain of oxygen/loss of hydrogen (or electrons) and reduction as the reverse — either definition is acceptable here; oxidation state method is more precise.
- 1 mark for correct identification + 1 mark for valid justification with oxidation states.

Q80. § 1.1 CHEMICAL EQUATIONS § 1.1.2 Balanced Chemical Equations § 1.2.4 Double Displacement Reaction

[1]



The reaction given above is a redox reaction because in this case :

- (a) MnO_2 is oxidised and HCl is reduced.
- (b) HCl is oxidised.
- (c) MnO_2 is reduced.
- (d) MnO_2 is reduced and HCl is oxidised.

Previously asked in: 2024 31/1/1 Q7

♦ Chemical Reactions and Equations

Redox Reactions – Simultaneous Oxidation and Reduction

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Model Answer

(d) MnO_2 is reduced and HCl is oxidised.

In this reaction, Mn in MnO_2 goes from +4 to +2 (gains electrons → reduction), while Cl in HCl goes from –1 to 0 in Cl_2 (loses electrons → oxidation).

Explanation

In a redox reaction, both oxidation and reduction must occur simultaneously. Check oxidation states: Mn drops from +4 to +2 (reduced), and Cl rises from –1 to 0 (oxidised). Options (a), (b), and (c) each describe only one half — only (d) correctly identifies both changes, making it the complete and correct answer.

Q81. § 1.1.2 Balanced Chemical Equations

[1]

Answer the following : Name the substance oxidised and reduced in the following reaction : $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$

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

♦ Chemical Reactions and Equations

Oxidation and reduction (redox reactions)

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Model Answer

In $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$, **ZnO (zinc oxide) is reduced** (loses oxygen) and **C (carbon) is oxidised** (gains oxygen).

Explanation

Oxidation = gain of oxygen; Reduction = loss of oxygen. ZnO loses oxygen to become Zn (reduced); C gains oxygen to become CO (oxidised). Carbon acts as the reducing agent here. Examiners expect both substances named with reason in one line for 1 mark.

Q82. § 1.2 TYPES OF CHEMICAL REACTIONS § 1.2.3 Displacement Reaction § 1.3 HAVE YOU OBSERVED THE EFFECTS OF
OXIDATION REACTIONS IN EVERYDAY LIFE?

[1]

Answer the following: In common practice silver is recovered from silver nitrate solution by the use of copper metal. Name the type of reaction that takes place in this process and give the chemical equation of the reaction involved.

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

♦ Chemical Reactions and Equations

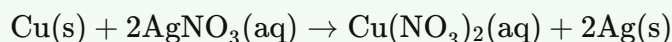
Chemical Equation Writing

Displacement Reaction

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Model Answer

It is a **displacement reaction**. Copper, being more reactive than silver, displaces silver from silver nitrate solution:



Source: Chapter 3, Section 3.2.4

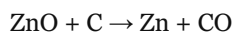
Explanation

Examiners expect both the name of the reaction type **and** the balanced equation. Since this is 1 mark, giving only one earns half credit. Note that copper displaces silver because Cu is higher in the reactivity series than Ag. Balance carefully: 2 AgNO₃ on the left, 2 Ag on the right.

Q83. § 1.1.2 Balanced Chemical Equations

[1]

Assertion (A) : In the following reaction



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 $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$, carbon removes oxygen from ZnO (reducing it to Zn), so ZnO is reduced and C acts as the reducing agent.

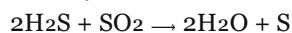
Explanation

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.

Q84. § 1.1.2 Balanced Chemical Equations § 1.2.1 Combination Reaction § 1.2.4 Double Displacement Reaction

[1]

Identify the correct statement about the following reaction :



- (A) H_2S is oxidising agent and SO_2 is reducing agent.
(B) H_2S is reduced to sulphur.
(C) SO_2 is oxidising agent and H_2S is reducing agent.
(D) SO_2 is oxidised to sulphur.

Previously asked in: 2024 31/2/1 Q6

♦ Chemical Reactions and Equations

Redox Reactions – Oxidation and Reduction

Types of Chemical Reactions

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Model Answer

(C) SO_2 is oxidising agent and H_2S is reducing agent.

In this reaction, S in H_2S goes from -2 to 0 (oxidised), so H_2S is the reducing agent. S in SO_2 goes from $+4$ to 0 (reduced), so SO_2 is the oxidising agent.

Explanation

- The agent that gets **oxidised** is the **reducing agent** (H_2S : sulphur $-2 \rightarrow 0$).
- The agent that gets **reduced** is the **oxidising agent** (SO_2 : sulphur $+4 \rightarrow 0$).
- Options A and D reverse these roles; option B wrongly says H_2S is *reduced*. Always check oxidation states of the same element on both sides to decide who is oxidised/reduced.

Q85. § 1.2.3 Displacement Reaction

Answer the following : Identify the type of chemical reaction that takes place when a solution of copper sulphate reacts with iron.

Previously asked in: 2023 31/5/1 Q28 (c)

♦ Chemical Reactions and Equations

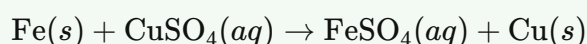
Displacement Reaction

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Model Answer

When a solution of copper sulphate reacts with iron, a **displacement reaction** takes place.

Iron, being more reactive than copper, displaces copper from copper sulphate solution. The reaction is:



The blue colour of copper sulphate solution fades and a brown deposit of copper forms on the iron nail.

Source: Chapter 1, Section 1.2.3 Displacement Reaction

Explanation

- The examiner expects you to **name the reaction type** (displacement) and **write the balanced equation** — both are needed for full marks.
- Mentioning that iron is more reactive than copper explains *why* displacement occurs, which earns extra credit.
- The observable change (fading blue colour, brown copper deposit) is a bonus point often asked in activity-based questions.

Q86. § 1.2 TYPES OF CHEMICAL REACTIONS § 1.2.3 Displacement Reaction § 1.2.4 Double Displacement Reaction**[2]**

Giving one example of each, differentiate between a displacement reaction and a double displacement reaction.

Previously asked in: 2024 31/2/1 Q21(b)

♦ Chemical Reactions and Equations

Displacement Reaction

Double Displacement Reaction

Types of Chemical Reactions

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Model Answer

Displacement Reaction: A more reactive element displaces a less reactive element from its compound.

Example: $\text{Fe} + \text{CuSO}_4 \rightarrow \text{FeSO}_4 + \text{Cu}$

Double Displacement Reaction: Two compounds exchange ions to form two new compounds.

Example: $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \rightarrow \text{BaSO}_4 \downarrow + 2\text{NaCl}$

Source: Chapter 1, Sections 1.2.3 & 1.2.4

Explanation

- Give **one definition + one equation** for each type — that covers both marks.
- Examiners look for the key distinction: in displacement, **one element** replaces another; in double displacement, **two ionic groups/atoms are exchanged** between two compounds.
- Always include state symbols ($\downarrow$ for precipitate) where relevant — it shows understanding and can earn bonus credit.

Q87. § 1.1 CHEMICAL EQUATIONS § 1.2 TYPES OF CHEMICAL REACTIONS § 1.2.1 Combination Reaction

[1]

Which of the following is a redox reaction, but not a combination reaction ?

- (A) $C + O_2 \rightarrow CO_2$
(B) $2 H_2 + O_2 \rightarrow 2 H_2O$
(C) $2 Mg + O_2 \rightarrow 2 MgO$
(D) $Fe_2O_3 + 3 CO \rightarrow 2 Fe + 3 CO_2$

Previously asked in: 2024 31/5/1 Q2

♦ Chemical Reactions and Equations

Redox Reactions (Oxidation and Reduction)

Types of Chemical Reactions

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Model Answer

(D) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

In this reaction, CO is oxidised (gains oxygen) and Fe_2O_3 is reduced (loses oxygen), making it a redox reaction. It is not a combination reaction as two reactants give two products.

Explanation

Options A, B, and C are both combination reactions (two reactants forming one product) AND redox reactions. Option D involves two reactants giving two products, so it is **not** a combination reaction, but it is a redox reaction because CO gets oxidised to CO_2 and Fe_2O_3 gets reduced to Fe. Examiners expect you to know both criteria to eliminate the wrong options.

Q88. § 2.4 MORE ABOUT SALTS

[1]

The oxide which can react with HCl as well as KOH to give corresponding salt and water is

- (A) CuO
(B) Al_2O_3
(C) Na_2O
(D) K_2O

Previously asked in: 2024 31/2/1 Q4

♦ Acids, Bases and Salts

Amphoteric oxides – reaction with acids and bases

Reaction of metal oxides with acids

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Model Answer

(B) Al_2O_3

Al_2O_3 is an amphoteric oxide — it reacts with HCl to form $AlCl_3 + H_2O$, and with KOH to form $KAlO_2 + H_2O$. CuO, Na_2O , and K_2O are basic oxides; they react with acids only.

Explanation

The key concept is **amphoteric oxides** — oxides that react with both acids and bases. Al_2O_3 is the classic example at the Class 10 level. CuO, Na_2O , and K_2O are purely basic oxides, so they react with HCl but **not** with KOH. Examiners expect you to recall that amphoteric oxides show dual behaviour.

Q89. § 2.1 UNDERSTANDING THE CHEMICAL PROPERTIES OF ACIDS AND BASES § 2.2 WHAT DO ALL ACIDS AND ALL BASES HAVE [1]
IN COMMON?

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** CO₂ gas turning lime water milky then colourless (excess CO₂ forming soluble calcium bicarbonate)
Reaction of Ca(OH)₂ solution with CO₂ – 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: $\text{Ca(OH)}_2 + \text{CO}_2 \rightarrow \text{CaCO}_3 \downarrow (\text{white/milky}) + \text{H}_2\text{O}$; then $\text{CaCO}_3 + \text{H}_2\text{O} + \text{CO}_2 \rightarrow \text{Ca(HCO}_3)_2$ (soluble, so colourless). Option (b) correctly identifies CaCO_3 as the cause of milkiness and soluble $\text{Ca(HCO}_3)_2$ as the reason for turning colourless. Options (c) and (d) wrongly mention sodium hydrogen carbonate or reverse the products.

Q90. § Group Activity

[1]

Answer the following : A compound 'A' is used in soda-lime fire-extinguisher and decomposes on heating to form compound 'B'. Compound 'B' is used for removing permanent hardness of water. Identify 'A' and 'B'.

Previously asked in: 2026 31/4/1 Q25 (a)

♦ **Acids, Bases and Salts** Sodium Carbonate and Sodium Hydrogencarbonate Thermal Decomposition Reaction

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Model Answer

A = Sodium bicarbonate (NaHCO₃) – used in soda-lime fire extinguishers.

B = Sodium carbonate (Na₂CO₃) – formed on heating A; used to remove permanent hardness of water.



Explanation

The key clues are: (1) used in soda-acid fire extinguisher $\rightarrow \text{NaHCO}_3$; (2) decomposes on heating $\rightarrow \text{Na}_2\text{CO}_3$ (washing soda); (3) washing soda removes permanent hardness by precipitating $\text{Ca}^{2+}/\text{Mg}^{2+}$ ions. Examiners expect both compounds identified with correct formula.

Q91. § 2.4 MORE ABOUT SALTS

[1]

A metal carbonate reacts with a solution X which forms a salt, water and a gas Y. What are X and Y ?

- (A) X – Sodium hydroxide, Y – Carbon dioxide
(B) X – Sodium hydroxide, Y – Hydrogen
(C) X – Hydrochloric acid, Y – Carbon dioxide
(D) X – Hydrochloric acid, Y – Hydrogen

Previously asked in: 2026 31/2/1 Q18

♦ Acids, Bases and Salts

Reaction of acids with carbonates

Reaction of metal carbonates with acids

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Model Answer

(C) X – Hydrochloric acid, Y – Carbon dioxide

When a metal carbonate reacts with an acid (HCl), it produces a salt, water, and CO₂ gas. Example: $\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$

Explanation

- Metal carbonates react with **acids**, not bases like NaOH — this eliminates options A and B.
- The gas released is always **CO₂** (not H₂) when a carbonate reacts with an acid — this eliminates option D.
- Remember the pattern: Carbonate + Acid → Salt + Water + CO₂↑

Q92. § 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) $\text{NaOH} + \text{Zn} \rightarrow \text{NaZnO}_2 + \text{H}_2\text{O}$
(b) $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2$
(c) $2\text{NaOH} + \text{Zn} \rightarrow \text{NaZnO}_2 + \text{H}_2$
(d) $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2\text{O}$

Previously asked in: 2024 31/1/1 Q1

♦ Metals and Non-metals

Amphoteric oxides of metals (ZnO, Al₂O₃)

Reaction of zinc with sodium hydroxide – balanced chemical equation

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Model Answer

(b) $2\text{NaOH} + \text{Zn} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2$

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: $2\text{NaOH(aq)} + \text{Zn(s)} \rightarrow \text{Na}_2\text{ZnO}_2\text{(s)} + \text{H}_2\text{(g)}$.
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 (Na₂ZnO₂ + H₂).

Q93. § 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

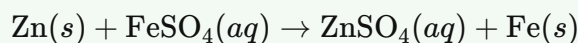
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Model Answer

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:



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 $\text{FeSO}_4 \rightarrow \text{P} = \text{Fe}$; (2) colourless product $\text{ZnSO}_4 \rightarrow \text{Q} = \text{Zn}$. The textbook directly gives the $\text{Zn} + \text{CuSO}_4$ 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.

Q94. § 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

Generated by claude-sonnet-4-6 · 2026-06-14 10:31 · grounding rag

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

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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