

CHEMICAL REACTIONS COMBINATION AND DECOMPOSITION REACTIONS SOLUTIONS

TEACHING TASK

JEE MAINS LEVEL QUESTIONS

1. When calcium nitrate ($\text{Ca}(\text{NO}_3)_2$) is heated strongly, it decomposes to give:

- A) $\text{CaO} + \text{N}_2 + \text{O}_2$ B) $\text{CaO} + \text{NO}_2 + \text{O}_2$ C) $\text{Ca}(\text{NO}_2)_2 + \text{O}_2$ D) $\text{Ca} + \text{N}_2 + 3\text{O}_2$

Solution: $2\text{Ca}(\text{NO}_3)_2 \rightarrow 2\text{CaO} + 2\text{N}_2 + 5\text{O}_2$

Answer: B

2. Which shows element + compound combination?

- A) $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$
 B) $\text{Cl}_2 + 2\text{KI} \rightarrow 2\text{KCl} + \text{I}_2$
 C) $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$
 D) $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$

Solution: SO_2 (sulfur dioxide) is a compound.

O_2 (oxygen) is an element.

Here, an element (O_2) reacts with a compound (SO_2) to form a new compound (SO_3).

Answer: A

3. Molten Al_2O_3 electrolysis produces:

- A) $\text{Al} + \text{O}_3$ B) $\text{Al} + \text{O}_2$ C) $\text{Al}_2 + \text{O}_2$ D) $\text{Al}^3 + \text{O}^{2-}$

Solution: $2\text{Al}_2\text{O}_3 \xrightarrow{\text{Electrolysis}} 4\text{Al} + 3\text{O}_2$

Answer: B

4. $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \rightarrow \text{X} + \text{Y} + \text{Z}$. Products are:

- A) $\text{N}_2 + \text{Cr}_2\text{O}_3 + \text{H}_2\text{O}$ B) $\text{NH}_3 + \text{CrO}_3 + \text{H}_2$ C) $\text{NO}_2 + \text{CrO}_4 + \text{H}_2$ D) $\text{N}_2\text{O} + \text{Cr}_2\text{O}_5 + \text{H}_2\text{O}$

Solution: $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \rightarrow \text{N}_2 + 2\text{Cr}_2\text{O}_3 + 4\text{H}_2\text{O}$

Answer: A

5. Silver bromide decomposition in photography:

- A) Endothermic B) Exothermic C) Redox D) Both B & C

Solution:



The decomposition of AgBr is both endothermic and a redox reaction.

Answer: A, C

6. Haematite (Fe_2O_3) reduction in blast furnace involves:

- A) CO as reducing agent B) Electrolysis C) Thermal decomposition D) Photolysis

Solution: $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$

CO as reducing agent

Answer: A

7. Ozone decomposition is unusual because:

- A) It's endothermic B) It's exothermic despite being decomposition
C) It produces atomic oxygen D) It requires catalyst

Solution: The decomposition of ozone (O_3) is unusual because it is exothermic despite being a decomposition reaction

Answer: B

8. $H_2CO_3 \rightarrow X + Y$. Products are:

- A) $H_2 + CO_3$ B) $H_2O + CO$ C) $H_2O + CO_2$ D) $H_2 + CO_2$

Solution: ~~H_2CO_3~~ H_2CO_3

Answer: C

9. $Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3$ is:

- A) Displacement + Exothermic B) Combination + Endothermic
C) Decomposition D) Double displacement

Solution: Displacement (Single Replacement): Aluminum (Al) displaces iron (Fe) from Fe_2O_3 because Al is more reactive.

Exothermic: The reaction releases a tremendous amount of heat (enough to melt the iron produced).

Answer: A

10. $CO + H_2O \rightarrow CO_2 + H_2$ is:

- A) Redox + Exothermic B) Combination C) Decomposition D) Photochemical

Solution: Redox (Oxidation-Reduction):

Carbon in CO is oxidized from +2 to +4 (in CO_2).

Hydrogen in H_2O is reduced from +1 to 0 (in H_2).

Exothermic: The reaction releases heat ($\Delta H^\circ \sim -41$ kJ/mol at standard conditions).

Answer: A

JEE ADVANCED LEVEL QUESTIONS

Multi correct answer type:

11. Which of the following reactions are exothermic decomposition reactions?

A) $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$ (Brown gas evolution)

B) $2KClO_3 \rightarrow 2KCl + 3O_2$ (Catalyzed by MnO_2)

C) $(NH_4)_2Cr_2O_7 \rightarrow N_2 + Cr_2O_3 + 4H_2O$ (Volcano experiment)

D) $CaCO_3 \rightarrow CaO + CO_2$ (Limestone calcination)

Solution: A) $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$ (Brown gas evolution)

This is a thermal decomposition reaction requiring heat.

It absorbs heat $\rightarrow$ Endothermic

B) $2KClO_3 \rightarrow 2KCl + 3O_2$ (Catalyzed by MnO_2)

Also a thermal decomposition reaction

Endothermic, even though catalyst (MnO_2) lowers the temperature needed

C) $(NH_4)_2Cr_2O_7 \rightarrow N_2 + Cr_2O_3 + 4H_2O$ (Volcano experiment)

This is a famous exothermic decomposition

Releases heat, sparks, and steam

D) $CaCO_3 \rightarrow CaO + CO_2$ (Limestone calcination)

Decomposition: Ammonium dichromate breaks down into multiple products.

D) $CaCO_3 \rightarrow CaO + CO_2$ (Limestone calcination)

Requires high heat, used in lime kilns. Hence, it is endothermic

Answer:C

12. Select decomposition reactions that can be driven by electrolysis:

A) $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$ (Acidified water)

B) $2\text{Ag}_2\text{O} \rightarrow 4\text{Ag} + \text{O}_2$ (Silver oxide decomposition)

C) $2\text{Al}_2\text{O}_3 \rightarrow 4\text{Al} + 3\text{O}_2$ (Hall-Héroult process)

D) $2\text{NaCl} \rightarrow 2\text{Na} + \text{Cl}_2$ (Down's process)

Solution: A) $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$ (Acidified water)

Electrolysis of Water: Direct current splits water into hydrogen and oxygen.

Key Point: Requires an electrolyte (e.g., dilute H_2SO_4) to enhance conductivity.

B) $2\text{Ag}_2\text{O} \rightarrow 4\text{Ag} + \text{O}_2$ (Silver oxide decomposition)

Thermal Decomposition: Silver oxide decomposes on heating ($\sim 300^\circ\text{C}$), not via electrolysis.

Key Point: No external electric current is needed.

C) $2\text{Al}_2\text{O}_3 \rightarrow 4\text{Al} + 3\text{O}_2$ (Hall-Héroult process)

Electrolysis of Molten Al_2O_3 : Cryolite (Na_3AlF_6) lowers the melting point, enabling aluminum extraction.

Key Point: Industrial method for producing aluminum.

D) $2\text{NaCl} \rightarrow 2\text{Na} + \text{Cl}_2$ (Down's process)

Electrolysis of Molten NaCl : Produces sodium metal and chlorine gas.

Key Point: Requires high temperatures to melt NaCl .

Answer:A,C,D

Statement Type:

13. Statement I: The reaction $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$ is a decomposition reaction that releases oxygen gas.

Statement II: Potassium chlorate decomposes because chlorine is more electronegative than oxygen, causing O_2 liberation.

Solution: Statement I:

"The reaction $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$ is a decomposition reaction that releases oxygen gas." (True.)

This is a classic thermal decomposition reaction where potassium chlorate (KClO_3) breaks down into potassium chloride (KCl) and oxygen gas (O_2).

The evolution of O_2 gas is a key observation (often tested in labs with a glowing splint).

Statement II:

"Potassium chlorate decomposes because chlorine is more electronegative than oxygen, causing O_2 liberation." (False).

The real reason for decomposition is the instability of the chlorate ion (ClO_3^-) upon heating, not electronegativity.

While chlorine (Cl) is indeed more electronegative than oxygen (O), this does not directly explain O_2 release. The reaction occurs because heating provides enough energy to break the weaker Cl-O bonds, favoring the formation of stable O_2 and KCl .

Answer:C

14. Statement I: Heating $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ at 150°C results in a color change from pink to violet, indicating decomposition.

Statement II: The reaction $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2 \rightarrow [\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+} + 2\text{Cl}^-$ involves

breaking of Co-N coordinate bonds.

Solution:

Statement-I: True

The pentamminechlorocobalt(III) chloride complex does undergo thermal decomposition at elevated temperatures.

The color change from pink to violet is characteristic of changes in cobalt complex coordination geometry (from octahedral to possibly tetrahedral or other configurations).

This is indeed indicative of chemical decomposition.

Statement-II: False

The equation shown represents simple ionic dissociation in solution, not thermal decomposition.

This dissociation does not break any Co-N coordinate bonds - it only separates the counterions (Cl^-) from the complex cation.

Actual thermal decomposition at 150°C would involve breaking of Co-N bonds and more extensive structural changes.

The color change in Statement I results from more fundamental changes in the coordination sphere than just ionic dissociation.

Answer: C

Comprehension Type:**Comprehension - I**

15. Which of the following is a correct example of a combination reaction?

- A) ($2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$) B) ($\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$)
C) ($2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$) D) ($\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$)

Solution: A combination reaction is defined as a reaction where two or more reactants combine to form a single product. ($\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$)

Answer: B

16. Which statement about combination reactions is correct?

- A) They always require heat to proceed.
B) They produce more than one product.
C) They involve the formation of a single compound from simpler substances.
D) They only occur between two elements, never compounds.

Solution: Combination reactions always form a single product from multiple reactants.

Answer: C

Comprehension - II

17. Which of the following best describes a decomposition reaction?

- A) Two or more reactants combine to form a single product.
B) A single compound breaks down into simpler substances (elements or new compounds).
C) One element replaces another in a compound.
D) Ions exchange partners between two compounds.

Solution: A decomposition reaction is defined as, A single compound breaks down into two or more simpler substances (which can be elements or new compounds).

Answer: B

18. What is typically required to initiate a decomposition reaction?

- A) A catalyst only B) An energy source (heat, light, or electricity)

C) A solvent

D) Another reactant

Solution: Decomposition reactions always need energy to proceed, whether from heat, light, or electricity.

Answer: B

Integer type:

19. Number of products formed when potassium chlorate (KClO₃) decomposes thermally?

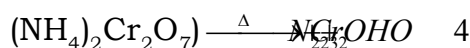
Solution: $2\text{KClO}_3 \xrightarrow{\Delta} 2\text{KCl} + 3\text{O}_2 \uparrow$

Answer: 2

20. Number of gaseous products formed when ammonium dichromate ((NH₄)₂Cr₂O₇) decomposes?

Solution: When ammonium dichromate ((NH₄)₂Cr₂O₇) decomposes, it produces two gaseous products:

Nitrogen gas, Water vapor



Answer: 2

Matrix Matching Type:

21. **Column-I**

- A. Chile saltpetre
- B. Lunar caustic
- C. Washing soda
- D. Indian saltpetre
- E. Philosopher's wool

Column-II

- 1. KNO₃
- 2. Na₂CO₃·10H₂O
- 3. AgNO₃
- 4. NaNO₃
- 5. ZnO

Solution: A. Chile saltpetre → 4. NaNO₃ (Sodium nitrate, a major natural source of nitrates).

B. Lunar caustic → 3. AgNO₃ (Silver nitrate, historically used in medicine and photography).

C. Washing soda → 2. Na₂CO₃·10H₂O (Hydrated sodium carbonate, used in detergents).

D. Indian saltpetre → 1. KNO₃ (Potassium nitrate, used in gunpowder and fertilizers).

E. Philosopher's wool → 5. ZnO (Zinc oxide, a white powder formed by burning zinc in air).

Answer: A-4, B-3, C-2, D-1, E-5

LEARNERS TASK

CONCEPTUAL UNDERSTANDING QUESTIONS (CUQ's)

1. $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ is an example of:

- A) Decomposition B) Combination C) Displacement D) Redox

Solution: Combination Reaction (B)

Definition: A reaction where two or more reactants combine to form a single product.

Here: Hydrogen (H_2) and oxygen (O_2) combine to form water (H_2O).

Key Point: Only one product is formed.

Answer: B

2. Thermal decomposition of CaCO_3 produces:

- A) $\text{CaO} + \text{CO}$ B) $\text{Ca} + \text{CO}_2$ C) $\text{CaO} + \text{CO}_2$ D) $\text{CaC}_2 + \text{O}_2$

Solution: $\text{CaCO}_3 \xrightarrow{\Delta} \text{CaO} + \text{CO}_2$

Answer: C

3. Which reaction releases oxygen gas?

- A) $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$ B) $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
C) $\text{Na} + \text{Cl}_2 \rightarrow \text{NaCl}$ D) $\text{Zn} + \text{H}_2\text{SO}_4 \rightarrow \text{ZnSO}_4 + \text{H}_2$

Solution: This is a classic thermal decomposition reaction where potassium chlorate (KClO_3) breaks down when heated to produce potassium chloride (KCl) and oxygen gas (O_2). The release of oxygen gas is a key characteristic of this reaction.

Answer: A

4. The reaction $\text{Fe} + \text{S} \rightarrow \text{FeS}$ is a:

- A) Synthesis reaction B) Displacement reaction
C) Decomposition reaction D) Neutralization reaction

Solution: Synthesis (Combination) Reaction:

Definition: A reaction where two or more simple substances combine to form a more complex compound.

Answer: A

5. Electrolysis of water is a:

- A) Combination reaction B) Decomposition reaction
C) Displacement reaction D) None

Solution: $2\text{H}_2\text{O} \xrightarrow{\text{Electricity}} 2\text{H}_2 + \text{O}_2$

Answer: B

6. Which is not a decomposition reaction?

- A) $2\text{HgO} \rightarrow 2\text{Hg} + \text{O}_2$ B) $2\text{AgCl} \rightarrow 2\text{Ag} + \text{Cl}_2$
C) $2\text{NH}_3 \rightarrow \text{N}_2 + 3\text{H}_2$ D) $2\text{Na} + \text{Cl}_2 \rightarrow 2\text{NaCl}$

Solution: Decomposition reactions involve one reactant breaking down into two or more products

Answer: D

7. Photodecomposition of AgBr is used in:

- A) Photography B) Electroplating
C) Smelting D) Catalysis

Solution: AgBr decomposes under light to form silver (Ag) and Br₂, capturing images on photographic film.

Answer:A

8.The reaction $2\text{NH}_4\text{Cl} + \text{Ca}(\text{OH})_2 \rightarrow \text{CaCl}_2 + 2\text{NH}_3 + 2\text{H}_2\text{O}$ is:

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

Solution:

Double Displacement Reaction: A reaction where two compounds exchange ions to form two new compounds.

Answer:B

9.Which requires an energy source?

- A) $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$ B) $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
C) $\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$ D) $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$

Solution: $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$

This reaction requires an energy source because:

It's a decomposition reaction (breaking water molecules apart)

Water molecules are very stable - their bonds require significant energy to break

In practice, this reaction needs either:

Electrical energy (electrolysis)

High thermal energy (thermolysis at ~2500°C)

Answer:B

10.The reaction $2\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$ is:

- A) Endothermic B) Exothermic C) Photochemical D) Electrolytic

Solution:This is the thermite reaction, known for its intense heat release

Answer:B

11.How many products form when $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ decomposes?

- A) 2 B) 3 C) 4 D) 5

Solution: $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \xrightarrow{\Delta} \text{N}_2 + \text{Cr}_2\text{O}_3 + 4\text{H}_2\text{O}$

Answer:B

12. Which decomposition reaction is used in airbags?

- A) $2\text{NaN}_3 \rightarrow 2\text{Na} + 3\text{N}_2$ B) $2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2$
C) $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ D) $2\text{H}_2\text{O}_2 \rightarrow 2\text{H}_2\text{O} + \text{O}_2$

Solution: $2\text{NaN}_3 \rightarrow 2\text{Na} + 3\text{N}_2$

When a collision occurs, an electric trigger detonates sodium azide (NaN₃).

The compound rapidly decomposes into:

Sodium metal (Na)

Nitrogen gas (N₂)

The N₂ gas inflates the airbag in milliseconds.

Answer:A

13.The Hall-Héroult process involves electrolytic decomposition of:

- A) Al₂O₃ B) Fe₂O₃ C) Cu₂S D) ZnO

Solution:This industrial method extracts aluminum metal from purified alumina (Al₂O₃).

Answer:A

14. Which reaction is both decomposition and redox?

- A) $2\text{Pb}(\text{NO}_3)_2 \rightarrow 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$ B) $\text{CaO} + \text{CO}_2 \rightarrow \text{CaCO}_3$
C) $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$ D) $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$

Solution: $2\text{Pb}(\text{NO}_3)_2 \rightarrow 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$

This reaction is both a decomposition and a redox reaction:

Decomposition: A single compound (lead nitrate, $\text{Pb}(\text{NO}_3)_2$) breaks down into three simpler substances (PbO , NO_2 , O_2).

Redox:

Oxidation: Nitrogen in NO_3^- goes from +5 (in $\text{Pb}(\text{NO}_3)_2$) to +4 (in NO_2).

Reduction: Oxygen in NO_3^- goes from -2 (in $\text{Pb}(\text{NO}_3)_2$) to 0 (in O_2).

Answer: A

15. The number of gaseous products in the decomposition of NH_4NO_3 is:

- A) 1 B) 2 C) 3 D) 0

Solution: $\text{NH}_4\text{NO}_3 \rightarrow \text{N}_2\text{O} + 2\text{H}_2\text{O}$

Gaseous Products:

Nitrous oxide (N_2O) – A colorless gas

Water vapor (H_2O) – Exists as gas at decomposition temperatures (~200–250°C)

Answer: B

JEE MAINS LEVEL QUESTIONS

16. Which is a thermal decomposition reaction?

- A) $2\text{HgO} \rightarrow 2\text{Hg} + \text{O}_2$ B) $\text{H}_2 + \text{Cl}_2 \rightarrow 2\text{HCl}$
C) $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$ D) $\text{Zn} + \text{CuSO}_4 \rightarrow \text{ZnSO}_4 + \text{Cu}$

Solution: $2\text{HgO} \rightarrow 2\text{Hg} + \text{O}_2$

Answer: A

17. Electrolytic decomposition of NaCl produces:

- A) $\text{Na} + \text{Cl}_2$ B) $\text{Na} + \text{Cl}$ C) $\text{Na}_2 + \text{Cl}_2$ D) $\text{Na}^+ + \text{Cl}^-$

Solution: $2\text{NaCl} \xrightarrow{\text{Electrolysis}} 2\text{Na} + \text{Cl}_2$

Answer: A

18. Photodecomposition is involved in:

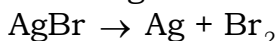
- A) Rusting of iron B) Black & white photography ($\text{AgBr} \rightarrow \text{Ag} + \text{Br}_2$)
C) Burning of methane D) Electroplating

Solution: Photodecomposition refers to chemical decomposition triggered by light energy.

Silver Bromide (AgBr) in Photography:

Photographic film contains AgBr crystals.

When light hits AgBr , it decomposes:



The silver atoms (Ag) form a latent image, which is later developed into a visible photograph

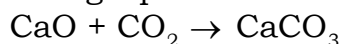
Answer: B

19. Which is a combination reaction?

- A) $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$ B) $\text{CaO} + \text{CO}_2 \rightarrow \text{CaCO}_3$



Solution: A combination reaction occurs when two or more reactants combine to form a single product



Answer: B

20. Synthesis of ammonia ($\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$) is:

- A) Endothermic B) Exothermic C) Redox D) Both B & C

Solution: Exothermic (B):

The reaction releases heat ($\Delta H = -92 \text{ kJ/mol}$ at standard conditions).

Industrial Haber process uses this heat release for efficiency.

Redox (C):

Oxidation: Hydrogen (H_2) goes from 0 to +1 in NH_3 .

Reduction: Nitrogen (N_2) goes from 0 to -3 in NH_3 .

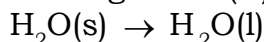
Answer: D

21. Which process is purely physical?

- A) Burning of paper B) Melting of ice
C) Fermentation of glucose D) Respiration

Solution: A purely physical process involves a change in state or appearance without altering the chemical composition of the substance.

Melting of Ice (B):



Only the physical state changes (solid $\rightarrow$ liquid); no new substances form.

Answer: B

22. Ripening of fruits involves:

- A) Oxidation B) Decomposition C) Enzymatic reactions D) All of the above

Solution: The ripening of fruits is a complex biochemical process involving:

Oxidation (A):

Oxygen interacts with fruit tissues, altering pigments (e.g., chlorophyll breaks down, revealing carotenoids).

Example: Ethylene (C_2H_4) production, a key ripening hormone, involves oxidative reactions.

Decomposition (B):

Complex carbohydrates (like starch) break down into simpler sugars (e.g., glucose, fructose), making the fruit sweeter.

Cell walls degrade (pectin breakdown), softening the fruit.

Enzymatic Reactions (C):

Enzymes like amylase (starch $\rightarrow$ sugar), pectinase (cell wall softening), and cellulase drive these changes.

Ethylene gas triggers enzyme production, accelerating ripening.

Answer: D

23. Industrial production of lime ($\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$) is:

- A) Endothermic B) Exothermic C) Photochemical D) Electrolytic

Solution: The reaction requires continuous heat input ($\Delta H = +178 \text{ kJ/mol}$) to proceed.

Temperatures of 900–1200°C are needed to decompose limestone (CaCO_3).

Answer: A

24. In the thermite reaction ($\text{Fe}_2\text{O}_3 + 2\text{Al} \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$), the role of Al is:

A) Oxidizing agent B) Reducing agent C) Catalyst D) Spectator ion

Solution: Oxidation State Change: Al goes from 0 (in Al) to +3 (in Al_2O_3).

Behavior: It donates electrons to reduce Fe_2O_3 , making it the reducing agent.

Answer: B

25. Number of gaseous products in $(\text{NH}_4)_2\text{Cr}_2\text{O}_7 \rightarrow \text{Cr}_2\text{O}_3 + \text{N}_2 + 4\text{H}_2\text{O}$:

A) 1 B) 2 C) 3 D) 0

Solution: When ammonium dichromate $((\text{NH}_4)_2\text{Cr}_2\text{O}_7)$ decomposes, it produces two gaseous products:

Nitrogen gas, Water vapor

Answer: B

JEE ADVANCED LEVEL QUESTIONS

Multi correct answer type:

26. The reaction $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ represents:

A) A redox reaction B) A synthesis reaction C) A combination reaction D) A decomposition reaction

Solution: Above reaction is A redox reaction, A synthesis reaction, A combination reaction

Answer: A, B, C

27. The reaction $4\text{Fe}(\text{s}) + 3\text{O}_2(\text{g}) + x\text{H}_2\text{O} \rightarrow 2\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}(\text{s})$ represents:

A) A corrosion process B) A combination reaction
C) An exothermic redox reaction D) A photochemical reaction

Solution: Corrosion Process (A):

This is the rusting of iron, where Fe reacts with O_2 and H_2O to form hydrated iron(III) oxide (rust, $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$).

Combination Reaction (B):

Multiple reactants ($\text{Fe} + \text{O}_2 + \text{H}_2\text{O}$) combine to form a single product ($\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$).

Exothermic Redox Reaction (C):

Oxidation: Iron (Fe) goes from 0 to +3 (in Fe_2O_3).

Reduction: Oxygen (O_2) goes from 0 to -2 (in Fe_2O_3 and H_2O).

The reaction releases heat (exothermic), though rusting is slow.

Answer: A, B, C

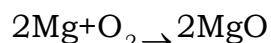
Statement Type:

28. Statement I: Magnesium ribbon burns in air with a dazzling white flame to form magnesium oxide.

Statement II: Magnesium reacts with hydrochloric acid to produce magnesium chloride and hydrogen gas.

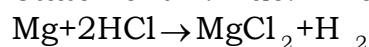
Solution:

Statement I: True. This is a classic demonstration of magnesium combustion:



The reaction is highly exothermic, producing intense white light

Statement II: True. This is a standard single displacement reaction:



However, Statement II does NOT explain Statement I. They describe two entirely different chemical reactions of magnesium:

Statement I describes combustion with oxygen

Statement II describes an acid-metal reaction

There is no causal or explanatory relationship between them.

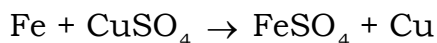
Answer:B

29. Statement I: When copper (II) sulphate reacts with iron, a brown deposit of copper is formed."

Statement II: This reaction is an example of a decomposition reaction, where copper sulphate breaks into copper and sulphur.

Solution:

Statement I: True. This is a classic single displacement reaction



The brown deposit is elemental copper (Cu) forming on the iron surface.

Statement II: False. This is incorrect because:

It's not decomposition - it's a displacement reaction (iron replaces copper)

Copper sulphate doesn't break into copper and sulphur - the sulphate (SO_4^{2-}) remains intact

The products are copper metal and iron sulphate, not elemental sulphur

Answer:C

Comprehension Type:

30. $\text{C} + \text{O}_2 \rightarrow \text{CO}_2 + \text{heat}$ is an example of:"

A) Combination reaction

B) Exothermic reaction

C) Decomposition reaction

D) Both A & B

Solution: Combination Reaction (A):

Two reactants (C and O_2) combine to form a single product (CO_2).

Exothermic Reaction (B):

The +heat indicates energy is released ($\Delta H = -393.5 \text{ kJ/mol}$ for complete combustion).

Answer:D

Integer type:

31. How many products are formed when calcium oxide (CaO) reacts with water (H_2O) in a combination reaction?

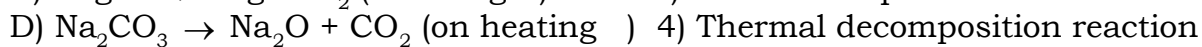
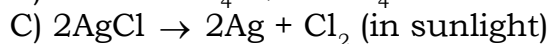
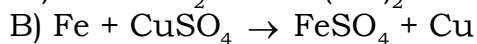
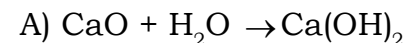
Solution: $\text{CaO} + \text{H}_2\text{O} \rightarrow \text{Ca(OH)}_2$ ()

Answer:1

Matrix Matching Type:

32. Solution:

COLUMN -I



COLUMN-II

1) Combination reaction

2) Displacement reaction

3) Photodecomposition reaction"

4) Thermal decomposition reaction

Answer:A-1,B-2,C-3,D-4

KEY

				TEACHING TASK					
1	2	3	4	5	6	7	8	9	10
B	A	B	A	A,C	A	B	C	A	A
11	12	13	14	15	16	17	18	19	20
C	ACD	C	C	B	C	B	B	2	2
21									
A-4,B-3,C-2,D-1,E-5									
				LEARNERS TASK					
1	2	3	4	5	6	7	8	9	10
B	C	A	A	B	D	A	B	B	B
11	12	13	14	15	16	17	18	19	20
B	A	A	A	B	A	A	B	B	D
21	22	23	24	25	26	27	28	29	30
B	D	A	B	B	ABC	ABC	B	C	D
31	32								
1 A-1,B-2,C-3,D-4									