Types of Reactions

Types of Reactions Introduction

> **Chemical reaction:** The reaction in which two or more substances react to form a new product with new properties is called a chemical reaction.
> **Chemical reaction shows following properties:**

1. The heat is evolved (either absorbed or released), bubbles may be given out, color may change or the pH may change.
2. The reactants react to give a new product. This involves the breaking of old bonds and formation of new bonds between the atoms.
3. The atoms of the reactant, either lose, gain or share electrons to form new compounds.
4. The total mass of the atoms reacting in the reaction is always conserved. The atoms are neither created nor destroyed, its mass and-number remains the same.

Types of chemical reactions: Combination reaction, decomposition reaction, displacement reaction, double displacement reaction, exothermic and endothermic reactions.
> **Combination Reaction:** When two or more reactants react together chemically to form a single product, the reaction is called combination reaction. The reactants can be two elements, an element and a compound or two compounds.

1. Combination reaction with two elements.

$$2Mg(s) + O_2(g) \longrightarrow 2MgO(s) + Heat$$

Magnesium oxygen Magnesium oxide

2. Combination reaction with two compounds.

$$CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq) + Heat$$

Quick lime Water Slaked lime

> **Decomposition Reaction:** When a compound breaks down to form simpler products, the reaction is called decomposition reaction. Decomposition can occur due to heat, light and electricity.

1. Decomposition due to heat

$$CaCO_3(s) \xrightarrow{Heat} CaO(s) + CO_2(g)$$

Limestone Quicklime

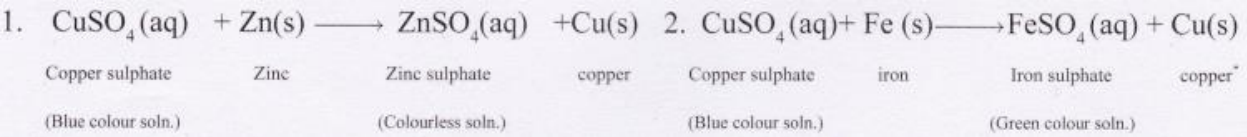
$$2Pb(NO_3)_2(s) \xrightarrow{Heat} 2PbO(s) + 4NO_2(g) + O_2(g)$$

lead nitrate Lead oxide Nitrogen dioxide oxygen

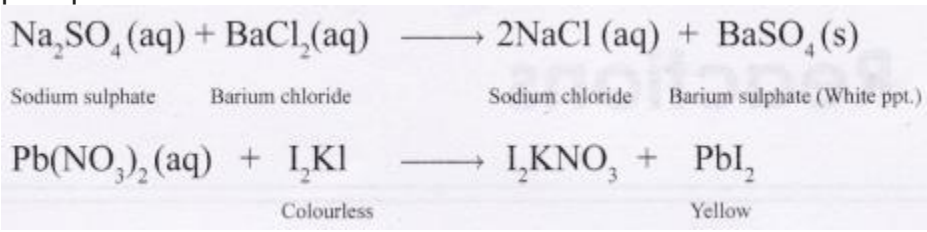
2. Decomposition due to electricity

$$2H_2O(l) \xrightarrow[current]{Electric-} 2H_2(g) + O_2(g)$$

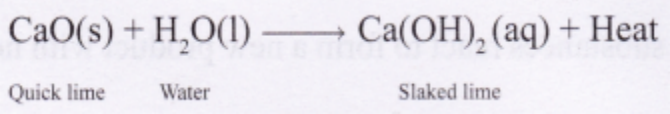
> Displacement Reaction: Metals have different reactivity, some are more reactive and some are less reactive. When a more reactive metal displaces a less reactive metal from its salt solution, the chemical reaction is called displacement reaction.



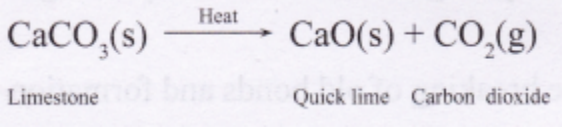
> Double Displacement Reaction: When two salt solutions (containing two different metallic ions) react with each other, the less reactive metallic ion is replaced by the more reactive metallic ion. Due to the interchanging of ions two new salts are formed. Such reaction is called double displacement reaction.
If the salt formed in the above reaction is insoluble in water then such reaction is called precipitation reaction.



> **Exothermic reaction:** In a chemical reaction, when heat is released then it is called exothermic reaction.



> **Endothermic reaction:** In a chemical reaction when heat is required for the chemical reaction to take place then it is called endothermic reaction.



Extended learning
> **SO_2:** Sulphur dioxide is a good reductant. In the presence of water, sulphur dioxide is able to decolourize substances. Specifically, it is a useful for bleaching papers and delicate materials such as clothes. Oxygen in the atmosphere reoxidizes the reduced dyes, restoring the colour.
> **SO_3:** Sulphur trioxide will cause serious bums on both inhalation and ingestion since it is highly corrosive in nature. SO_3 should be handled with extreme care as it reacts with water violently and produces highly corrosive sulphuric acid.

Science Lab Manual Experiment 3

Aim

To perform and observe the following reactions and classify them into:
(a) Combination reaction (b) Decomposition reaction
(c) Displacement reaction (d) Double displacement reaction.

1. Action of water on quick lime.
2. Action of heat on ferrous sulphate crystals.

3. Iron nails kept in copper sulphate solution.
4. Reaction between sodium sulphate and barium chloride solutions.

Theory

Action of water on quick time

> Quick lime is calcium oxide (CaO). It combines with water to form calcium hydroxide [$Ca(OH)_2$] also called as slaked lime.

$$\underset{\text{Quick lime}}{CaO(s)} + \underset{\text{Water}}{H_2O(l)} \longrightarrow \underset{\text{Slaked lime}}{Ca(OH)_2\,(aq)} + \text{Heat}$$

> Two substances are combining to form one product, hence it is a combination reaction.
> Heat is released in the reaction, hence it is called as exothermic reaction.
> Slaked lime solution turns red litmus blue, hence it is basic in nature.
> The freshly prepared slaked lime is also called as lime water.
> It turns milky when carbon dioxide gas is passed through it.

Action of heat on ferrous sulphate crystals

> Ferrous sulphate crystals are light green in colour. The colour is due to the water of crystallization.
> On heating the crystals of ferrous sulphate, it undergoes following changes:

$$\underset{\substack{\text{Ferrous sulphate}\\(\text{Light green})}}{2FeSO_4 \cdot 7H_2O(s)} \longrightarrow \underset{\substack{\text{Ferric oxide}\\(\text{Brown})}}{Fe_2O_3(s)} + \underset{\substack{\text{Sulphur dioxide}\\(\text{Colourless})}}{SO_2(g)} + \underset{\substack{\text{Sulphur trioxide}\\(\text{Colourless})}}{SO_3(g)} + 14H_2O$$

> The colour changes to brown and gases are released due to the formation of new compounds.
> Single compound decomposes to form three new compounds, hence it is called as decomposition reaction.
> SO_2 and SO_3 gas turns moist blue litmus paper into red, hence it is acidic in nature.
> SO_2 shows reducing property: It changes the orange colour of acidified potassium dichromate to green when SO_2 gas is allowed to pass through it.
> Water of crystallisation is released by the crystals.
> SO_2 gas has choking smell, do not inhale the gas, keep the mouth of the test tube away from your face.

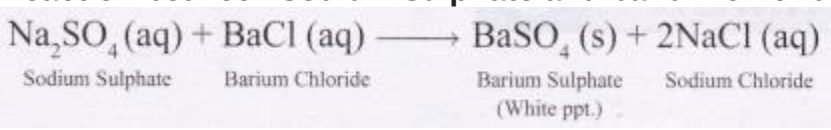
Iron nails kept in copper sulphate solution

$$\underset{\substack{\text{Iron}\\(\text{Grey})}}{Fe(s)} + \underset{\substack{\text{Copper sulphate}\\(\text{Blue})}}{CuSO_4(aq)} \longrightarrow \underset{\substack{\text{Ferrous sulphate}\\(\text{Light green})}}{FeSO_4(aq)} + \underset{\substack{\text{Copper}\\(\text{Reddish brown})}}{Cu(s)}$$

> Iron nails when kept in blue coloured solution of copper sulphate, shows following changes:

(a) The blue colour solution changes slowly into light green colour.
(b) Fe^{2+} ions replace Cu^{2+} ions and form iron sulphate in the solution, hence, this is called as displacement reaction.
(c) Iron nail gets the deposit of reddish copper ions on it.
(d) Fe atom forms Fe^{2+} ions by loss of electrons and undergoes oxidation and Cu^{2+} ions gain electrons to become Cu atom and undergoes reduction.

Reaction between sodium sulphate and barium chloride solutions



> Sodium sulphate solution and barium chloride solution are colourless.
> Mixing of both the solutions gives white colour precipitate due to the formation of barium sulphate
> The exchange of ions takes place in the reaction and is called as double displacement reaction.
> Barium sulphate is insoluble in water and hence it forms precipitate.

Materials Required

A beaker, four test tubes, test tube holder, tongs, test tube stand, a dropper, a piece of sand paper and bunsen burner. **Chemicals required:** A small piece of quick lime, ferrous sulphate crystals, iron nails (clean and unrusted), copper sulphate solution,

sodium sulphate solution, barium chloride solution and distilled water.

Procedure

	Experiment	Observation	Inference
1.	*Combination Reaction:* Take a clean beaker, add a small piece of lime in it. Add water drop by drop into the beaker. *Equation:* $CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq) + Heat$ (Calcium oxide (Quick lime); Water; Calcium hydroxide (Slaked lime))	Reaction occurs with crackling sound and steamy vapours are released. The beaker becomes hot.	An exothermic and combination reaction occurs.
2.	*Decomposition Reaction:* Take a clean and dry test tube, add few crystals of ferrous sulphate. Fix it on a test tube holder. Heat the test tube on burner, keeping the mouth of test tube away from your face. Waft the gas released to smell and test it with acidified potassium dichromate paper. *Equation:* $2FeSO_4.7H_2O(s) \xrightarrow{Heat} Fe_2O_3(s) + SO_2(g) + SO_3(g) + 14H_2O$ (Ferrous sulphate Green crystals; Ferric oxide; Colourless gases; Water of crystallisation) $K_2Cr_2O_7(aq) + H_2SO_4(aq) + 3SO_2(g) \longrightarrow Cr_2(SO_4)_3 + K_2SO_4(aq) + H_2O$ (Chromium Sulphate)	The green crystals become reddish-brown, tiny droplets of water are settled near the neck of test tube and a colourless gas is evolved. The acidified potassium dichromate changes its colour from orange to green when held in gas.	Iron sulphate green crystals decomposes due to heat. Water of crystallisation is collected in the test tube. Sulphur dioxide gas has choking smell. It changes potassium dichromate paper green. Its a decomposition reaction.
3.	*Displacement Reaction:* Take a clean test tube, add 2-3 mL of copper sulphate solution in it. Place a clean iron nail in it. Keep it on the test tube stand and observe the changes for 30 minutes. *Equation:* $CuSO_4(aq) + Fe(s) \longrightarrow FeSO_4(aq) + Cu(s)$ (Blue; Grey; Light green; Brick red)	The blue colour copper sulphate slowly changes its colour. The iron nail gets the deposit of reddish copper ions. The blue colour of copper sulphate solution changes to green.	Iron metal is reactive than copper, displaces it to form iron sulphate solution. Its a displacement reaction and red deposit of copper is formed on the nail.
4.	*Double Displacement Reaction:* In a clean test tube, take sodium sulphate solution, to this add barium chloride solution. Shake the contents and observe. *Equation:* $Na_2SO_4(aq) + BaCl_2(aq) \longrightarrow BaSO_4(s) + 2NaCl(aq)$ (Colourless; Colourless; White ppt.)	Both sodium sulphate and barium chloride solutions are colourless, on mixing together a white precipitate is formed.	The white insoluble precipitate of barium sulphate is formed. It is a double displacement reaction.

Precautions

1. Do not touch quick lime with hands, use tongs.
2. Mixing of quick lime and water releases large amount of heat, so add water drop by drop and use borosil beaker.
3. For heating, use hard glass tubes.
4. Never inhale any gas, just waft the gas.
5. Do not touch any chemical with hands.
6. Keep the mouth of the test tube away from your face while heating.

7. The iron nails must be cleaned properly by using sand paper before dipping them in copper sulphate solution.

Science Lab Manual Viva Voce

Question 1:
Give two examples of combination reaction.

$$2Mg(s) + O_2(g) \longrightarrow 2MgO(s)$$
$$C(s) + O_2(g) \longrightarrow CO_2(g)$$

Question 2:
When lead nitrate is mixed with potassium iodide solution, name the compound that is formed and give yellow precipitate.
Answer:
When lead nitrate and potassium iodide are mixed, it forms lead iodide that is yellow precipitate and the other product is potassium nitrate.

Question 3:
What happens if iron nail is dipped in green-coloured ferrous sulphate solution?
Answer:
There is no change.

Question 4:
What is blue vitriol and green vitriol?
Answer:
Blue vitriol is $CuSO_4.5H_20$
Green vitriol is $FeSO_4.7H_20$.

Question 5:
What is the chemical name and formula of lime?
Answer:
Calcium oxide, CaO.

Question 6:
Name the type of reaction when blue vitriol, i.e., $CuSO_4.5H_2O$ is heated.
Answer:
It is a decomposition reaction.

Question 7:
What is the chemical formula of limestone?
Answer:
Formula of limestone is $CaCO_3$

Question 8:
$FeSO_4.7H_2O$ is the formula for ferrous sulphate. What does $7H_2O$ stand for?
Answer:
$7H_2O$ is water of crystallisation, i.e., one molecule of $FeSO_4$ needs seven water molecules to form a crystal.

Question 9:
What is the nature of sulphur dioxide and sulphur trioxide gas?
Answer:
Both SO_2 and SO_3 are acidic in nature.

Question 10:
What is the colour of iron and copper metal?
Answer:
The iron metal is grey in colour and copper metal is reddish-brown in colour.

Question 11:
Give the balanced chemical equation to show the reaction between sodium sulphate and barium chloride.
Answer:

$$Na_2SO_4\,(aq) + BaCl_2\,(aq) \longrightarrow BaSO_4\,(s) + 2NaCl\,(aq)$$

Science Lab Manual Practical Based Questions

Question 1:
State three types of decomposition reaction.
Answer:
Three types of decomposition reaction are due to

(*a*) Heat	$CaCO_3(s)$	$\longrightarrow CaO(s) + CO_2(g)$
(*b*) Sunlight	$2AgBr(s)$	$\longrightarrow 2Ag(s) + Br_2(g)$
(*c*) Electric current	$2H_2O(l)$	$\longrightarrow 2H_2(g) + O_2(g)$

Question 2:
Barium chloride solution mixes with sodium sulphate solution to form a white precipitate. The precipitate occurs due to which salt.
Answer:
The white precipitate occurs due to formation of barium sulphate.

Question 3:
What happens when zinc is added to blue colour copper sulphate?
Answer:
The blue-coloured copper sulphate becomes colourless.

Question 4:
Iron nail is dipped in blue-coloured copper sulphate solution. What are the observations?
Answer:
Iron nail gets reddish-brown coating and the blue-coloured copper sulphate solution becomes green.

Question 5:
If you add water in lime (CaO), what changes will you observe?
Answer:
The reaction between lime (CaO) and water is highly exothermic. Large amount of heat is released with the formation of $Ca(OH)_2$ slaked lime.

Question 6:
State the condition necessary for displacement reaction.
Answer:
Displacement reaction is possible only when a more reactive metal displaces the less reactive metal.

Question 7:
Name the colour of the gas formed when lead nitrate is heated.
Answer:
Brown colour gas of nitrogen dioxide is formed.

Question 8:
What is the chemical formula of lime water? What is it commonly called?
Answer:
The chemical formula of lime water is $Ca(OH)_2$. $Ca(OH)_2$ is commonly called as slaked lime.

Question 9:
Carbon dioxide gas should be passed through lime water only for a short duration. Explain why?
Answer:
Less carbon dioxide gas will turn lime water milky but excess of CO_2 gas will make it colourless.

Question 10:
What is the chemical obtained when excess CO_2 is passed through lime water?
Answer:
On passing excess of CO_2 gas through lime water, calcium bicarbonate ($CaHCO_3$) is formed which is soluble in water.

Question 11:
What happens when sodium sulphate and barium chloride solution react together?
Answer:
Sodium chloride and a white precipitate of barium sulphate are formed.

Question 12:
What do you mean by an aqueous solution?
Answer:
The solution that is made in water is called as an aqueous solution.

Question 13:
What do you mean by precipitate solution?
Answer:
When the solution obtained is not soluble in water, then we say precipitate is obtained.

Question 14:
Name the products obtained on decomposition of ferrous sulphate crystals.
Answer:
On decomposition of ferrous sulphate crystals, the products obtained are Fe_2O_3, SO_2, SO_3 and $14H_20$, i.e., Iron oxide, sulphur dioxide, sulphur trioxide and water.

Science Lab Manual Questions

Question 1:
Why does the colour of copper sulphate change, when an iron nail is dipped in it?
Answer:
On adding iron nail in copper sulphate the displacement reaction takes place. Iron being more reactive than copper displaces copper to form green solution of iron sulphate and copper (pinkish brown) metal is displaced.

Question 2:
How would you devise the procedure to show that Mg > Fe > Cu in reactivity series?
Answer:
Step 1: Add Mg metal in ferrous sulphate, taken in one test tube and to copper sulphate taken in another test tube, wait for some time and note the observations.
Step 2: Add Fe metal in magnesium sulphate taken in one test tube and to copper sulphate taken in another test tube, wait for some time and record the observations.
Step 3: Add Cu metal in a test tube with magnesium sulphate and to other test tube with ferrous sulphate in it. Observe and record.
You will note that magnesium can displace Fe and Cu from their salt solutions, Fe can displace only copper from its salt solution and Cu cannot displace any of the metals from the salt solutions.
Hence, the reactivity can be checked and proved that Mg is the most reactive metal and copper is the least reactive metal among Mg, Fe and Cu.

Question 3:
What is the basic principle involved in this experiment?
Answer:
The more reactive metal can displace the less reactive metal.

Question 4:
Why the following reaction does take place?

$$2I^-(aq) + Cl_2(aq) \xrightarrow{CCl_4} 2Cl^-(aq) + I_2 \text{ (solvated)}$$

Answer:
Chlorine is more reactive than iodine, hence it displaces the iodide ions from its aqueous solution and release iodine.

Question 5:
Sodium sulphate and barium chloride are _____ (ionic/covalent) compounds.
Answer:
Ionic.

Question 6:
As the white precipitate of barium sulphate is formed _____ (immediately/sometime after mixing
the two solutions), the reaction between _____ (ionic/covalent) compounds is _____ (instantaneous/slow).
Answer:
immediately, ionic, instantaneous.

Question 7:
What may happen on mixing $Pb(NO_3)_2$ and KCl solutions? Predict (you may try to experimentally verify).
Answer:
The displacement reaction takes place and yellow colour precipitate of lead iodide is formed.

Reaction: $Pb(NO)_3 + 2KI \longrightarrow 2KNO_3 + PbI_2$

Question 8:
What are the industrial applications of the type of reaction being studied?
Answer:
These reactions are used in the extraction of metals in industries. These reactions are also helpful in packaging, food processing industries.

Science Lab Manual Multiple Choice Questions (MCQs)

Questions based on Procedural and Manipulative Skills

1. The addition of water in lime is
(a) endothermic reaction
(b) decomposition reaction
(c) exothermic reaction
(d) displacement reaction.

2. The compound also known as blue vitriol is
(a) $FeSO_4.7H_2O$ (b) $CuSO_4.5H_2O$
(c) $CaSO_4.2H_2O$ (d) $Na_2CO_3.10H_2O$.

3. The chemical formula for lime is
(a) $Ca(OH)_2$ (b) $CaCO_3$
(c) CaO (d) $CaHCO_3$.

4. The chemical formula for slaked lime is
(a) $Ca(OH)_2$ (b) $CaCO_3$
(c) CaO (d) $CaHCO_3$.

5. The chemical formula of lead nitrate is:
(a) KNO_3 (b) $PbNO_3$
(c) $K(NO_3)_2$ (d) $Pb(NO_3)_2$.

6. The reaction of water and quick lime is an example of
(a) combination reaction
(b) exothermic reaction
(c) both (a) and (b)
(d) none of these.

7. How many water molecules are present in a crystal of copper sulphate molecule?
(a) 5
(b) 7
(c) 2
(d) 3.

8. How many water molecules are present in a crystal of ferrous sulphate molecule?
(a) 5
(b) 2
(c) 7
(d) 10.

9. Which of the following is an endothermic reaction?

(a) $CaCO_3 \xrightarrow{heat} CaO + CO_2$

(b) $CaO + H_2O \longrightarrow Ca(OH)_2$

(c) $C_6H_{12}O_6 + O_2 \longrightarrow 6CO_2 + 6H_2O$

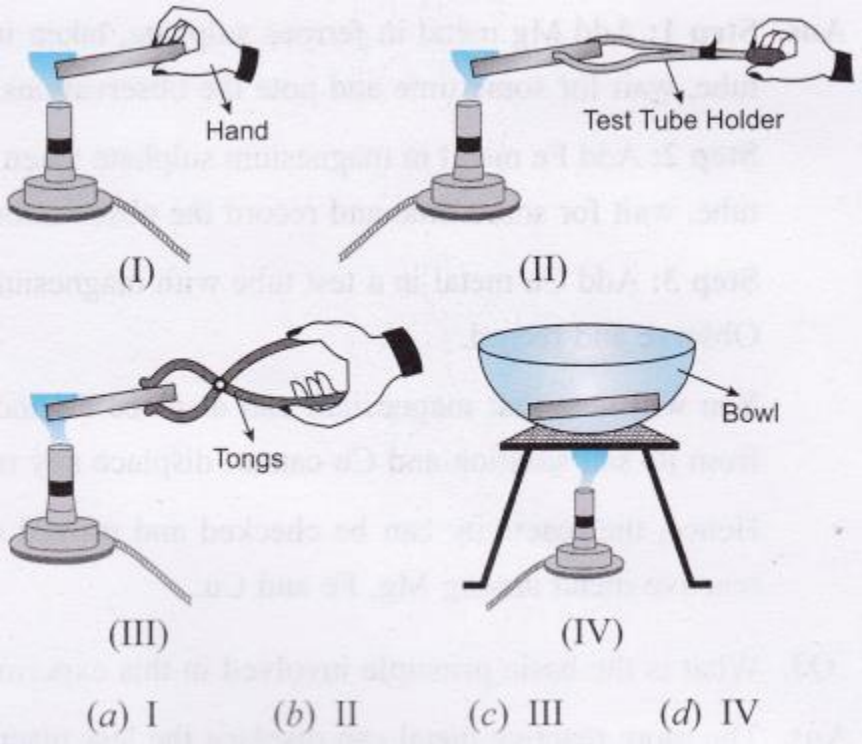
(d) None of these

10. What is the colour of $FeSO_4.7H_2O$?
(a) blue
(b) green
(c) white
(d) brown.

11. What is the colour of $CuSO_4.5H_2O$?
(a) blue
(b) green
(c) white
(d) yellow.

12. Four students used different ways of burning magnesium ribbon during an experiment as shown below.

The correct way has been followed by student:



Science Lab Manual Questions based on Observational Skills

13. The copper coin is dipped in blue coloured copper sulphate solution, the colour obtained after half an hour is
(a) reddish
(b) brownish
(c) colourless
(d) blue colour.

14. When iron nail js kept in blue coloured copper sulphate solution, after a while the colour obtained in the test tube for the solution is
(a) blue
(b) brown
(c) green
(d) red.

15. On adding zinc granules to freshly prepared ferrous sulphate solution a student observes that:
(a) a dull brown coating is formed
(b) a black coating is formed
(c) a greyish coating is formed
(d) no coating is formed.

16. A student strongly heats hydrated ferrous sulphate salt in a dry test tube. He would observe a:
(a) yellow residue
(b) brown residue
(c) light green residue
(d) white residue

17. A student while heating solid lead nitrate taken in a test tube would observe:
(a) white residue of PbO_2
(b) green residue of NO_2
(c) yellow residue of PbO
(d) brown residue of NO.

18. A student took solid quick lime in a china dish and added a small amount of water. He heard:
(a) a popping sound
(b) a crackling sound
(c) a hissing sound
(d) no sound at all.

19. The colour of the gas evolved on heating solid lead nitrate is:
(a) yellow
(b) brown
(c) greenish-yellow
(d) green.

20. When a cleaned iron nail is placed in copper sulphate solution, the colour of the solution changes to:
(a) blue
(b) red
(c) pale violet
(d) pale green.

21. When zinc granules are dipped in blue coloured copper sulphate solution, the colour of solution obtained is:
(a) blue
(b) yellow
(c) colourless
(d) brown.

22. In the reaction of sodium sulphate and barium chloride the colour of the precipitate formed is
(a) yellow
(b) green

(c) white
(d) black.

23. An iron nail was dipped in a salt solution. After sometime a reddish brown deposition of the nail was seen. The salt solution could be
(a) Silver nitrate
(b) Sodium sulphate
(c) Aluminium chloride
(d) Copper sulphate

24. The colour of the residue left in the test tube after heating ferrous sulphate which undergoes decomposition is:
(a) yellowish-brown
(b) black
(c) white
(d) grey.

25. When ferrous sulphate is heated strongly name the gas evolved?

(a) SO_2 (b) SO_3
(c) Fe_2O_3 (d) SO_2 and SO_3

26. On heating ferrous sulphate one would get
(a) sweet smell
(b) rotten egg smell
(c) irritating choking smell
(d) none of the above

Science Lab Manual Questions based on Reporting and Interpretation Skills

27. On adding water to lime we get:

(a) $Ca(OH)_2$ (b) $CaCO_3$
(c) CaO (d) $CaHCO_3$.

28. On passing CO_2 gas through slaked lime we get

(a) $CaCO_3$ (b) $CaHCO_3$
(c) $CaO + CO$ (d) $CaCO_3 + CO_2$.

29. On strong heating of ferrous sulphate crystals the products formed are:

(*a*) $FeO + SO_2$
(*b*) $FeO + SO_3 + H_2O$
(*c*) $Fe_2O_3 + SO_2$
(*d*) $Fe_2O_3 + SO_2 + SO_3 + 14H_2O$.

30. Magnesium metal burns in air with dazzling white flame. The type of chemical reaction seen is
(a) combination reaction
(b) decomposition reaction
(c) displacement reaction
(d) double decomposition.

31. The reaction of sodium sulphate and barium chloride produces a precipitate, the product formed that gives ppt. is
(a) sodium chloride
(b) barium sulphate
(c) barium sulphide
(d) none of these.

ANSWERS

1. (*c*)	2. (*b*)	3. (*c*)	4. (*a*)	5. (*d*)
6. (*c*)	7. (*a*)	8. (*c*)	9. (*a*)	10. (*b*)
11. (*a*)	12. (*c*)	13. (*d*)	14. (*c*)	15. (*c*)
16. (*b*)	17. (*c*)	18. (*b*)	19. (*b*)	20. (*d*)
21. (*c*)	22. (*c*)	23. (*d*)	24. (*a*)	25. (*d*)
26. (*c*)	27. (*a*)	28. (*a*)	29. (*d*)	30. (*a*)
31. (*b*)				

Science Lab Manual Scoring Key With Explanation

1. (c) Lime is calcium oxide and it releases heat when reacted with water.
2. (b) Copper sulphate crystals are blue in colour.
3. (c) Lime is calcium oxide.
4. (a) Slaked lime is calcium hydroxide.
5. (d) The valency of lead is 2 and nitrate ion is 1.
6. (c) Calcium oxide combines with water to form calcium hydroxide and heat is released.

7. (a) It is water of crystallization which is constant for each salt.
8. (c) It is water of crystallization which is constant for each salt.
9. (a) Heat is used for the reaction to occur.
10. (b) Ferrous salts are green in colour.
11. (a) Copper salts are blue in colour.
12. (c) Magnesium ribbon is to be burnt directly on the burner using tongs.
13. (d) Blue colour remains the same as copper and copper salt solution shows equilibrium.
14. (c) Fe is more reactive than Cu and can displace it.
15. (c) Zinc will displace Fe from its solution. The colour of Fe is greyish-black.
16. (b) FeO is formed which is brown in colour.
17. (c) Lead nitrate decomposes to form lead oxide which is yellow in colour.
18. (b) Highly exothermic reaction has occurred.
19. (b) Nitrogen dioxide gas is released which is brown in colour.
20. (d) Iron will displace Cu to form green colour iron sulphate.
21. (c) Zinc will displace Cu from copper sulphate solution and zinc salt solutions are colourless.
22. (c) Barium sulphate is white precipitate.
23. (d) The salt solution should be copper sulphate ($CuSO_4$). Iron displaces copper from its salt solution as a result of which a reddish-brown layer of Cu is deposited on iron nail.
24. (a) Iron oxide is formed which is brownish in colour.
25. $(d)\ 2FeSO_4 \longrightarrow \underset{\text{Brown}}{Fe_2O_3} + SO_2\uparrow + SO_3\uparrow$
26. (c) It is a decomposition reaction in which SO_2 and SO_3 are liberated which are choking.
27. (a) Calcium oxide reacts with water to form calcium hydroxide.
28. (a) Calcium hydroxide reacts with CO_2 to form calcium carbonate.
29. (d) Ferrous sulphate crystals decomposes to form these products.
30. (a) Mg bums in air to combine with oxygen and forms MgO.
31. (b) Double displacement reaction is seen.