

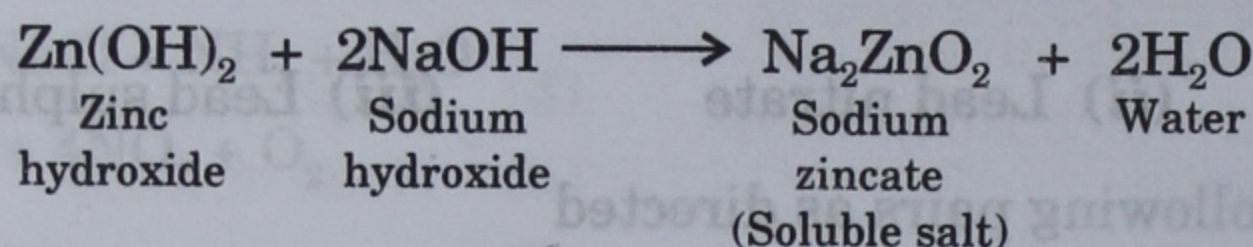
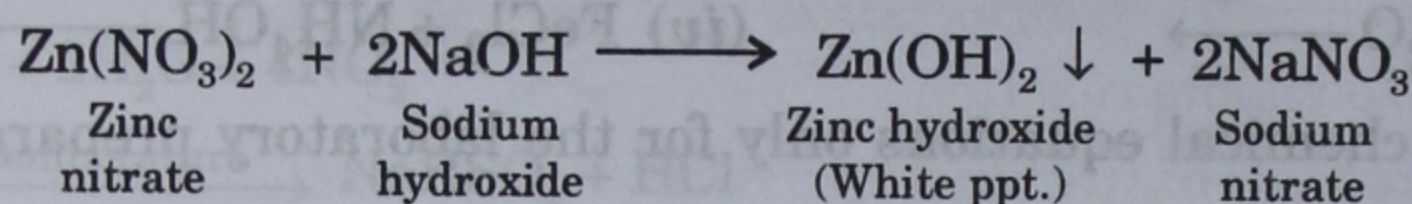
Analytical Chemistry— Use of Ammonium Hydroxide and Sodium Hydroxide

IMPORTANT POINTS TO REMEMBER

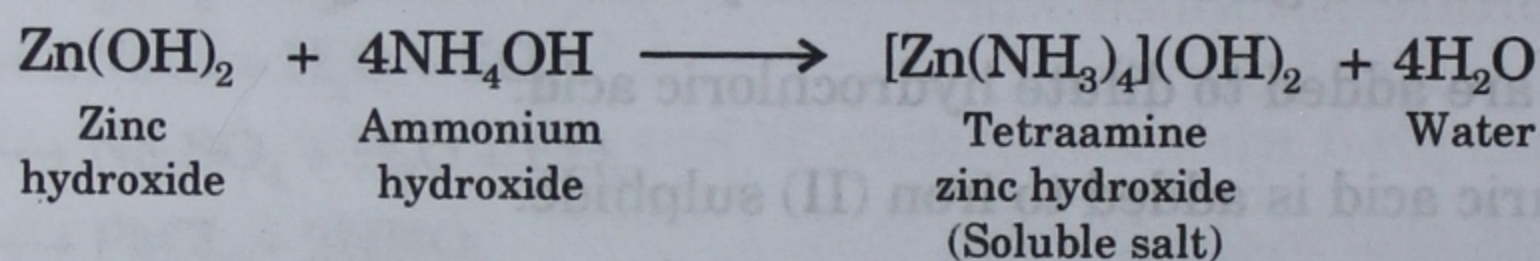
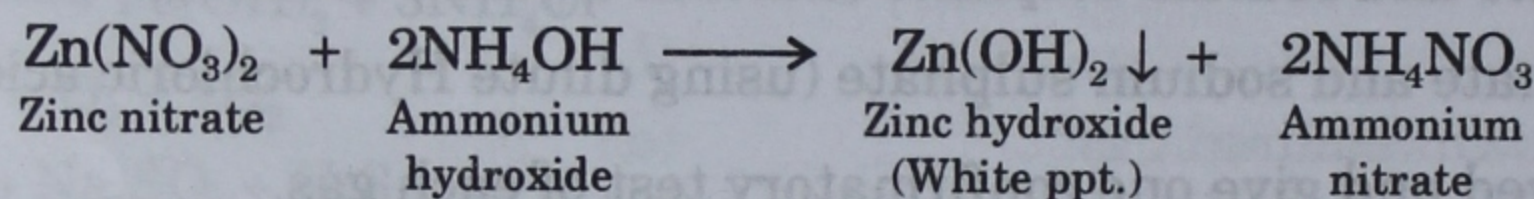
1. **Alkalies, i.e.,** Sodium hydroxide and Ammonium hydroxide react with the **soluble salts of metal** to precipitate **different coloured hydroxides**.

2. **Reaction of Sodium hydroxide and Ammonium hydroxide with soluble salt of Zinc :**

(a) **With NaOH :** On adding Sodium hydroxide drop by drop to a solution of Zinc salt a **white precipitate** is formed which is **soluble** in excess of Sodium hydroxide.

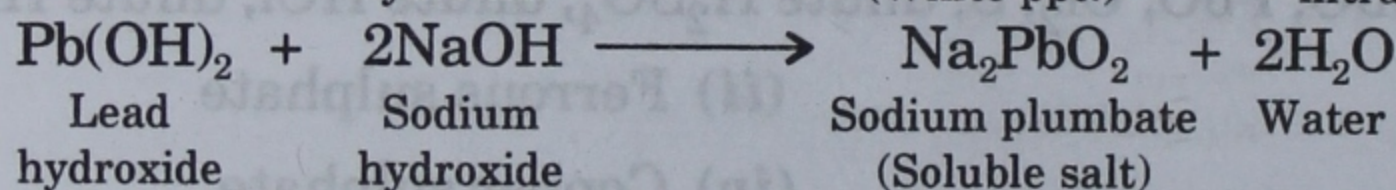
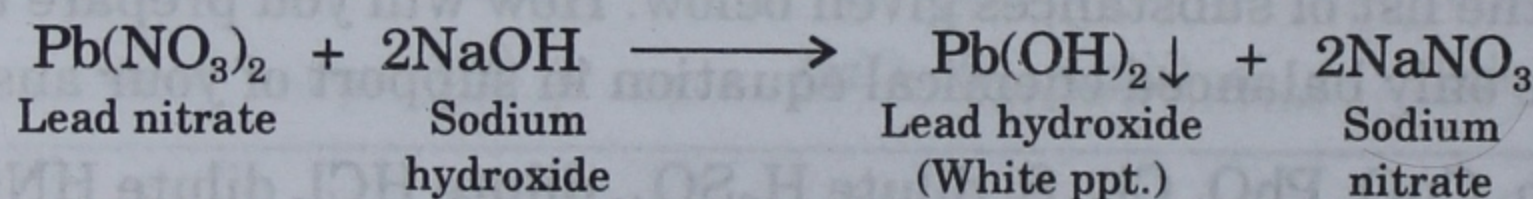


(b) **With NH₄OH :** On adding Ammonium hydroxide drop by drop to a solution of Zinc salt a **white precipitate** is formed which is **soluble** in excess of Ammonium hydroxide.

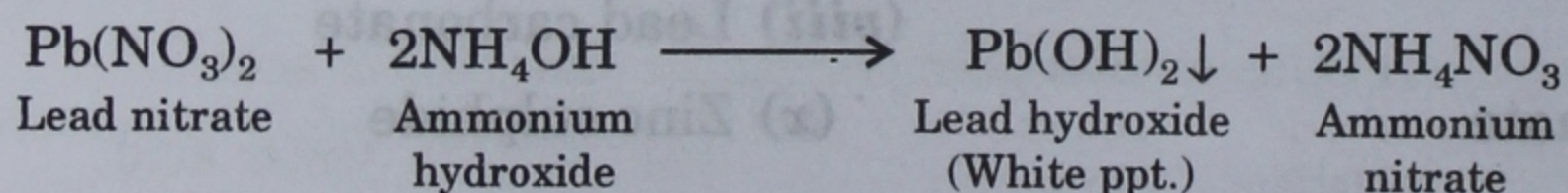


3. **Reaction of Sodium hydroxide and Ammonium hydroxide with the soluble salt of Lead :**

(a) **With NaOH :** On adding Sodium hydroxide drop by drop to a solution of Lead salt a **white precipitate** is formed which is **soluble** in excess of Sodium hydroxide.

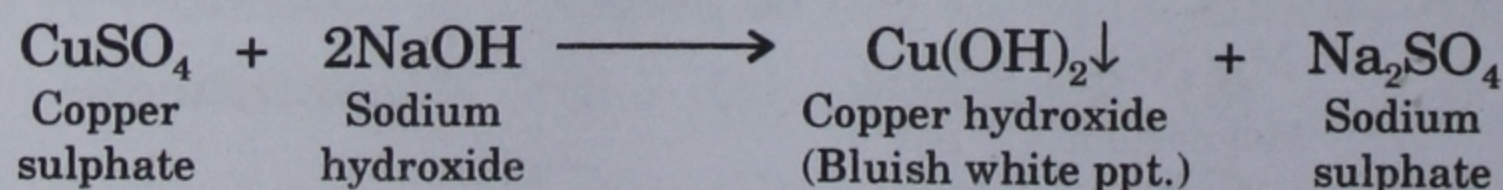


(b) **With NH₄OH :** On adding Ammonium hydroxide drop by drop to a solution of Lead salt a **white precipitate** is formed which is **insoluble** in excess of Ammonium hydroxide.

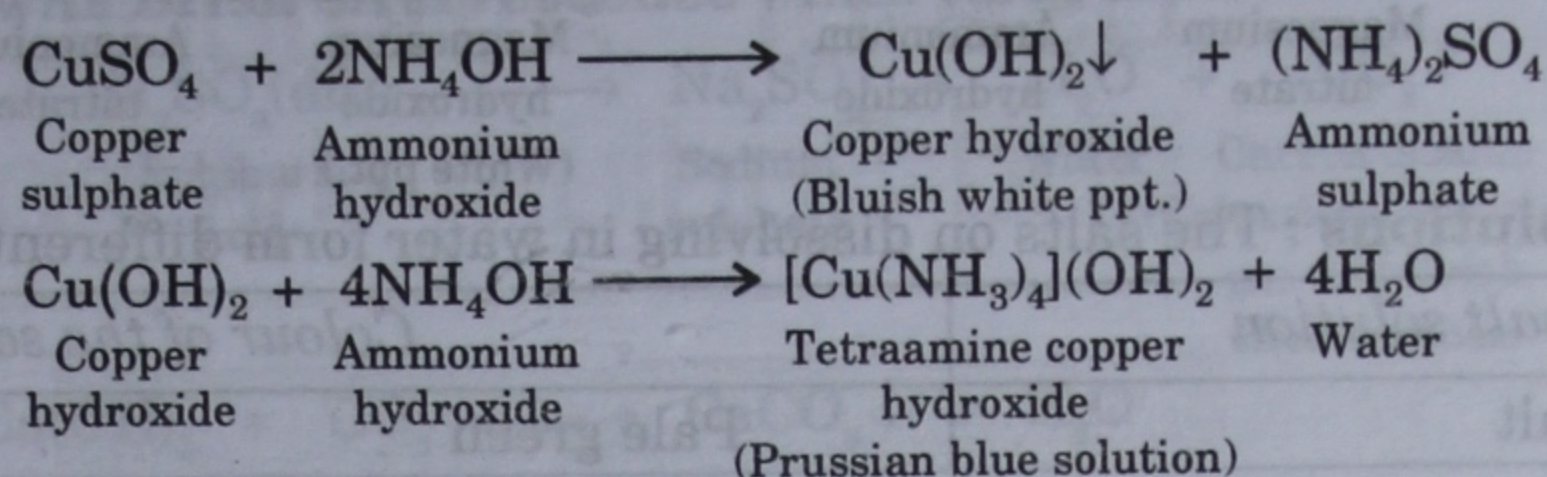


4. **Reaction of Sodium hydroxide and Ammonium hydroxide with the soluble salt of Copper :**

(a) **With NaOH :** On adding Sodium hydroxide drop by drop to a solution of Copper salt, a **bluish white precipitate** is formed which is **insoluble** in excess of Sodium hydroxide.

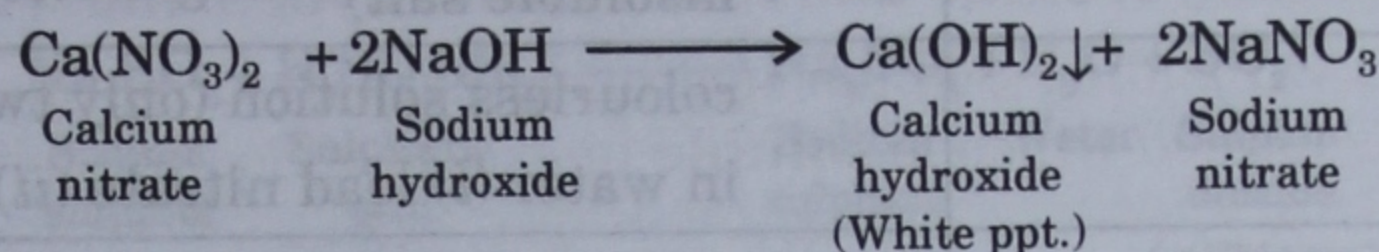


(b) **With NH_4OH** : On adding Ammonium hydroxide drop by drop to a solution of Copper salt a **pale blue or bluish white precipitate** is formed which dissolves in excess of Ammonium hydroxide to give **deep blue or inky blue or prussian blue solution**.



5. Reaction of Sodium hydroxide and Ammonium hydroxide with soluble salt of Calcium :

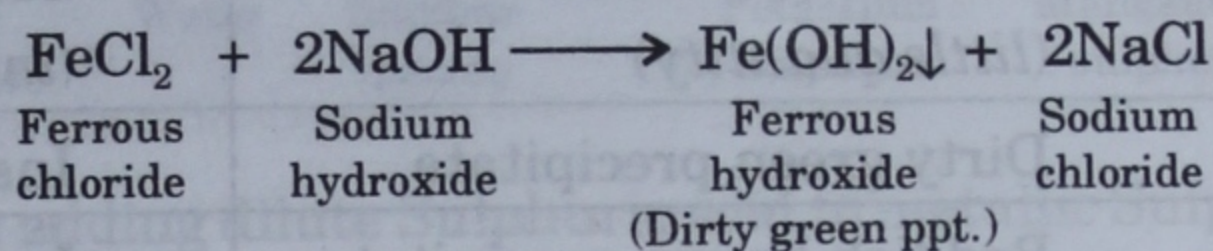
(a) **With NaOH** : On adding Sodium hydroxide drop by drop to a solution of Calcium salt, a **white precipitate** is formed which is **insoluble** in excess of Sodium hydroxide.



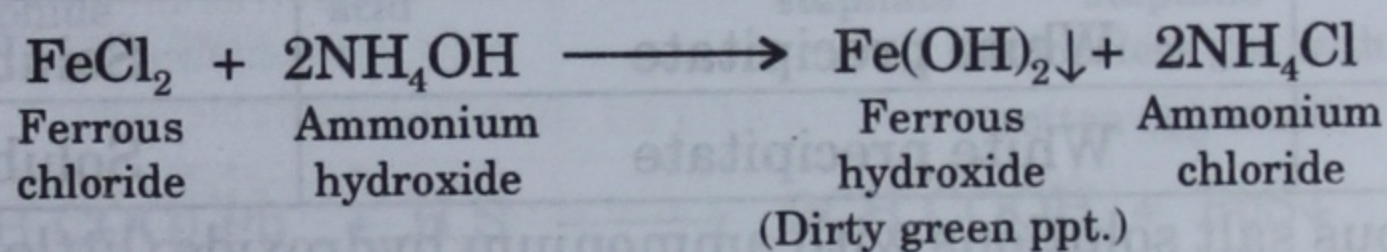
(b) **With NH_4OH** : No visible reaction.

6. Reaction of Sodium hydroxide and Ammonium hydroxide with soluble salt of Ferrous :

(a) **With NaOH** : On adding Sodium hydroxide drop by drop to a solution of Ferrous salt, a **dirty green precipitate** is formed which turns **reddish brown** after sometime and is **insoluble** in excess of Sodium hydroxide.

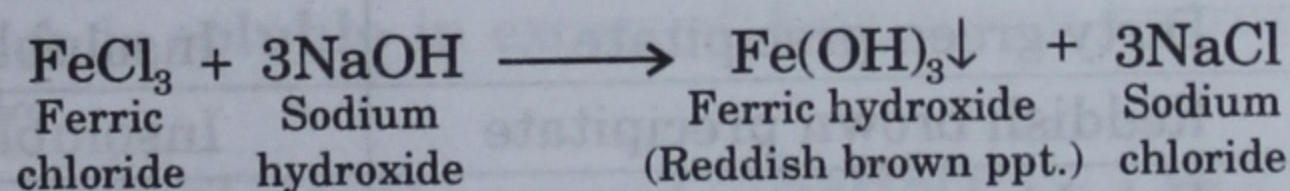


(b) **With NH_4OH** : On adding Ammonium hydroxide drop by drop to a solution of Ferrous salt a **dirty green precipitate** is formed which turns **reddish brown** after sometime and is **insoluble** in excess of Ammonium hydroxide.

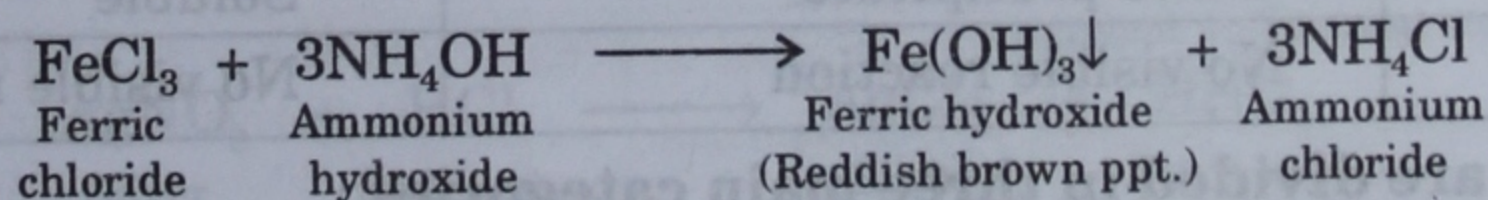


7. Reaction of Sodium hydroxide and Ammonium hydroxide with soluble salt of Ferric :

(a) **With NaOH** : On adding Sodium hydroxide drop by drop to a solution of Ferric salt, a **reddish brown precipitate** is formed which is **insoluble** in excess of Sodium hydroxide.

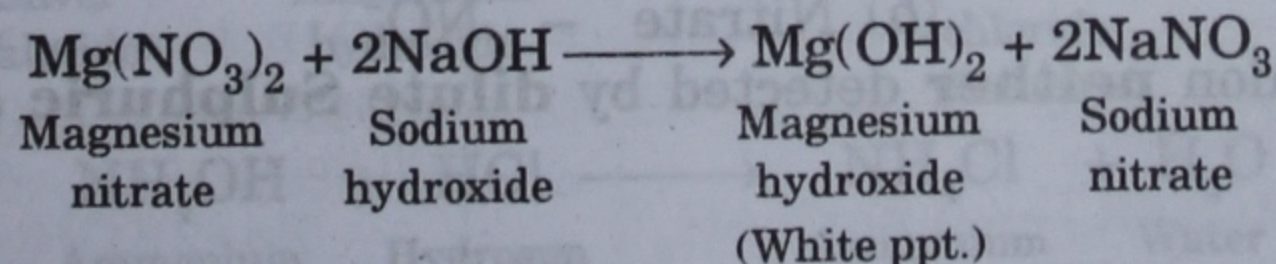


(b) **With NH_4OH** : On adding Ammonium hydroxide drop by drop to a solution of Ferric salt, a **reddish brown precipitate** is formed which is **insoluble** in excess of Ammonium hydroxide.

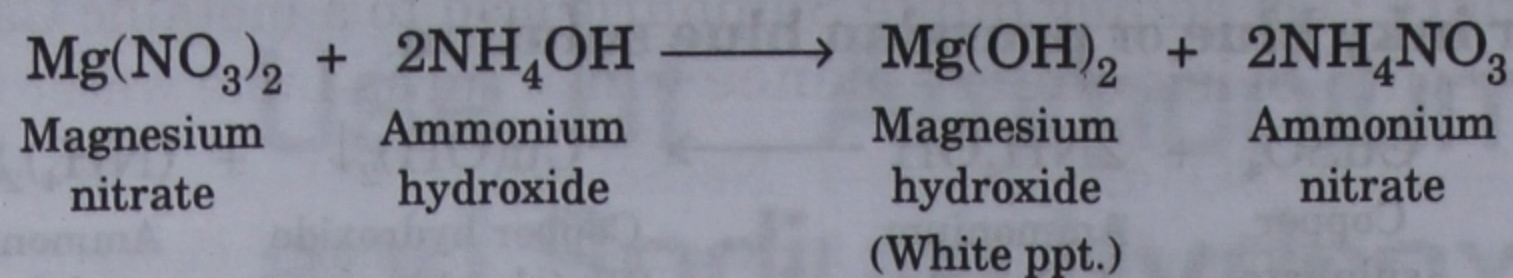


8. Reaction of Sodium hydroxide and Ammonium hydroxide with soluble salt of Magnesium :

(a) **With NaOH** : On adding Sodium hydroxide drop by drop to a solution of Magnesium salt, a **white precipitate** appears which is **insoluble** in excess of Sodium hydroxide.



(b) With NH_4OH : On adding Ammonium hydroxide drop by drop to a solution of Magnesium salt, a **white precipitate** appears which is **insoluble** in excess of Ammonium hydroxide.



9. **Colour of salt solutions** : The salts on dissolving in water form different coloured salt solutions.

Name of the salt solution	Colour of the salt solution
(i) Ferrous salt	Pale green
(ii) Ferric salt	Yellow
(iii) Cupric salt	Blue (except CuCO_3 which is a green coloured insoluble salt)
(iv) Lead salt	colourless solution (only two salts of lead are soluble in water (i) lead nitrate (ii) lead acetate)
(v) Zinc salt	colourless solutions
(vi) Calcium salt	colourless solutions

10. The reaction of various salt solutions with sodium hydroxide (little and excess) can be summarized below :

Salt solutions	Sodium hydroxide (little quantity)	Sodium hydroxide (in excess)
(i) Ferrous salt	Dirty green precipitate	Insoluble
(ii) Ferric salt	Reddish brown precipitate	Insoluble
(iii) Cupric salt	Pale blue precipitate	Insoluble
(iv) Lead salt	White precipitate	Soluble
(v) Zinc salt	White precipitate	Soluble
(vi) Calcium salt	White precipitate	Soluble

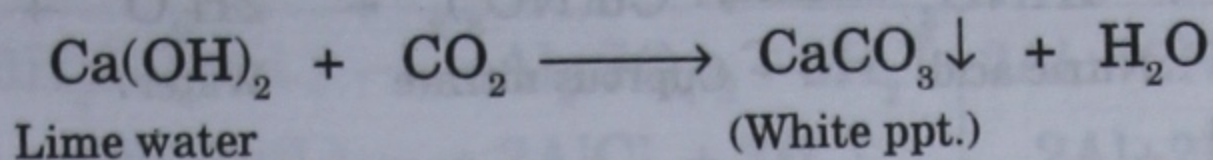
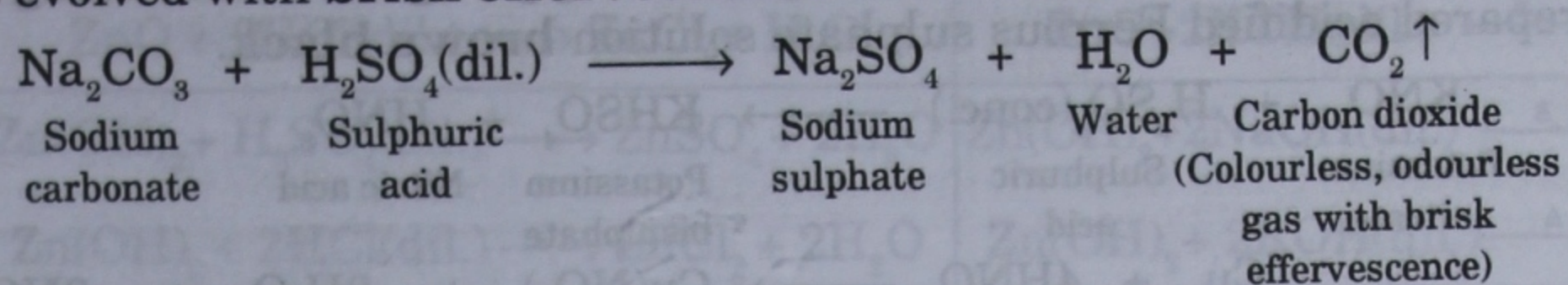
11. The reactions of various salt solutions with ammonium hydroxide (little and excess) can be summarized below :

Salt solution	Ammonium hydroxide (little)	Ammonium hydroxide (excess)
(i) Ferrous salt	Dirty green precipitate	Insoluble
(ii) Ferric salt	Reddish brown precipitate	Insoluble
(iii) Cupric salt	Pale blue precipitate	Soluble (gives deep blue solution)
(iv) Lead salt	White precipitate	Insoluble
(v) Zinc salt	White precipitate	Soluble
(vi) Calcium salt	No visible reaction	No visible reaction

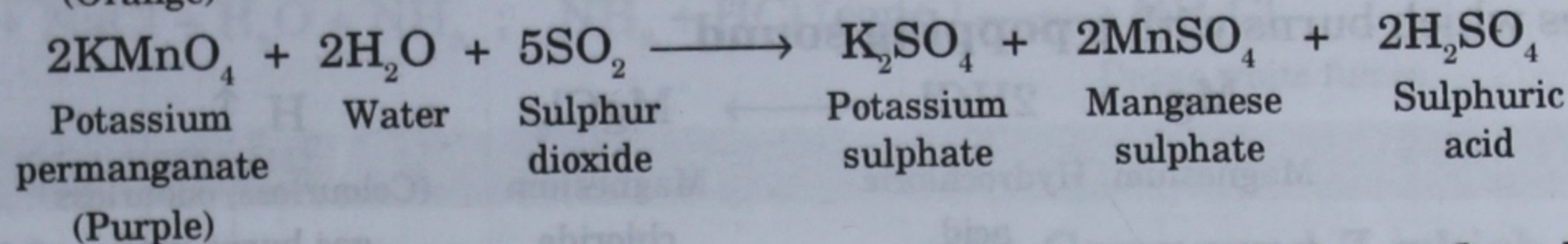
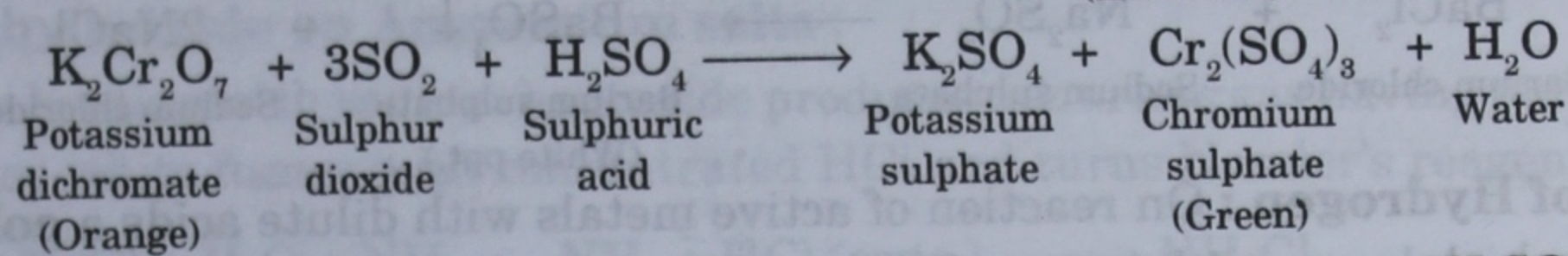
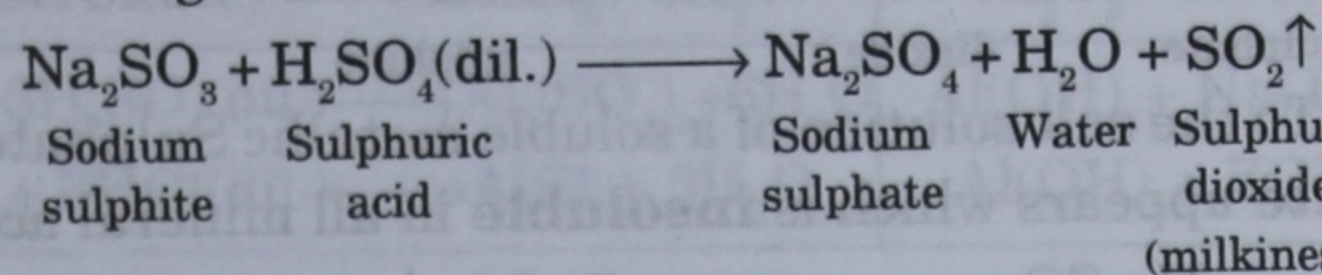
12. **The acid radicals are divided in three main categories :**

- (i) The acid radicals or anions detected by **dilute Sulphuric acid** are
 - (a) Carbonate - CO_3^{2-}
 - (b) Sulphite - SO_3^{2-}
 - (c) Sulphide - S^{2-}
- (ii) The acid radicals or anions detected by **concentrated Sulphuric acid** are
 - (a) Chloride - Cl^-
 - (b) Nitrate - NO_3^-
- (iii) The acid radical or anion **neither** detected by **dilute Sulphuric acid nor by concentrated Sulphuric acid** is Sulphate - SO_4^{2-}

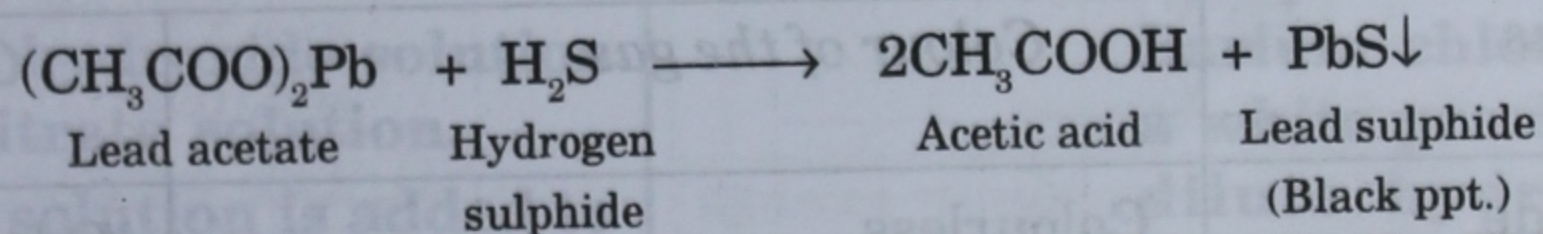
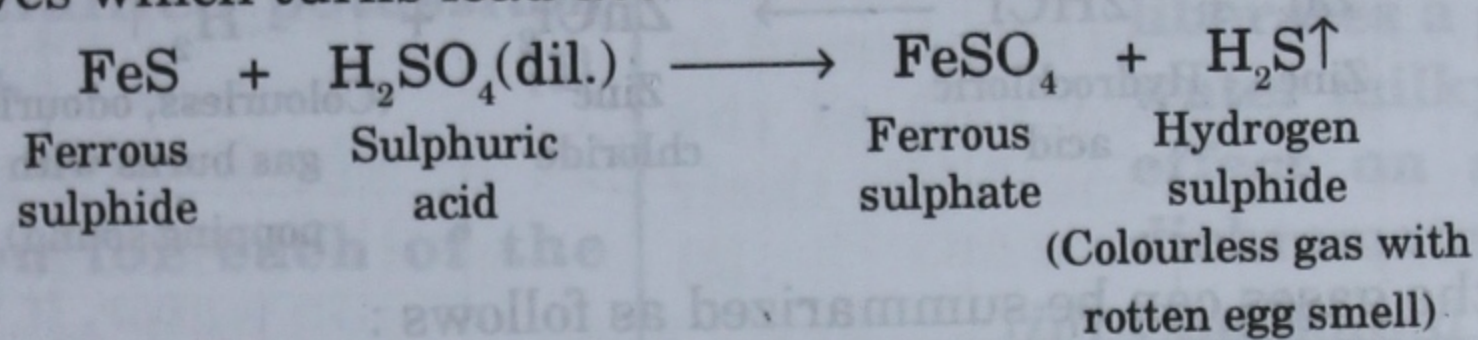
13. Detection of Carbonate : On adding dilute Sulphuric acid to a metallic Carbonate a **colourless and odourless gas** evolved with **brisk effervescence** which turns Lime water **milky**.



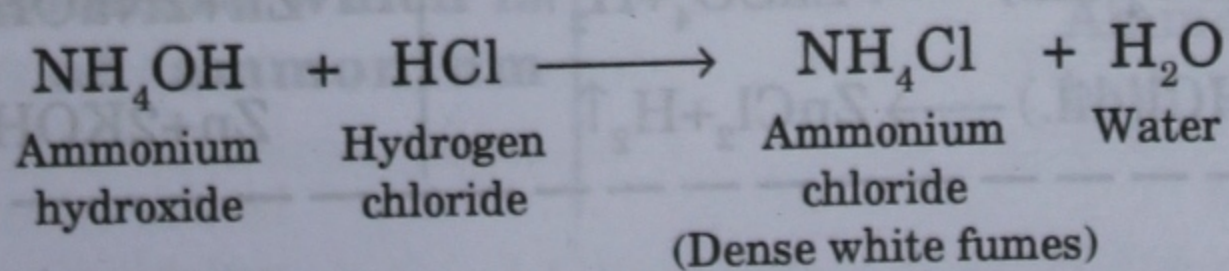
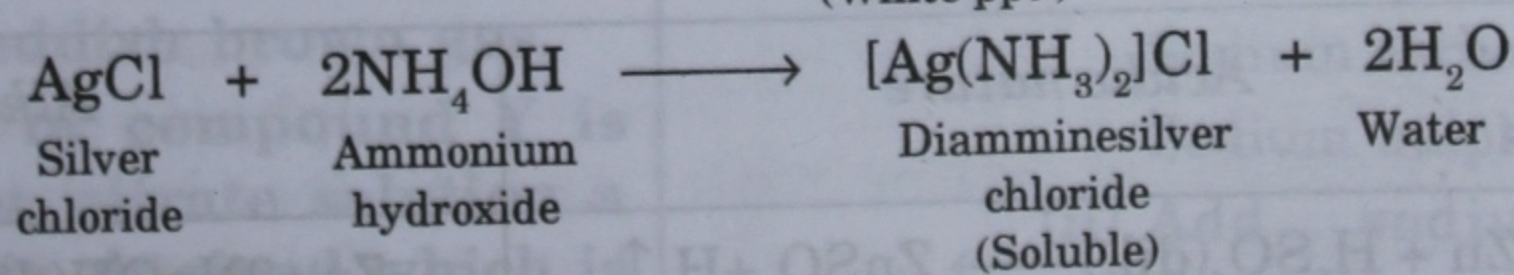
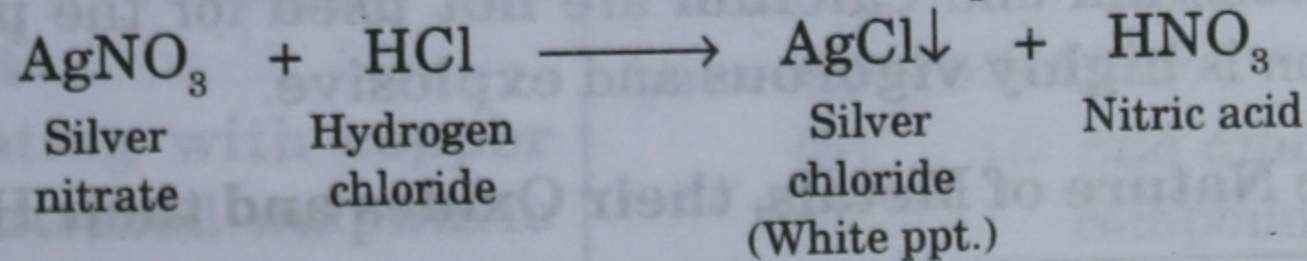
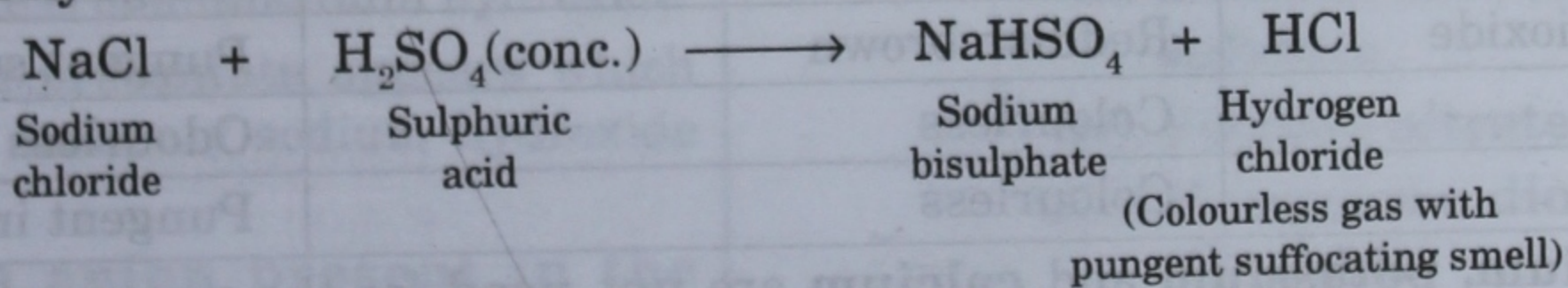
14. Detection of Sulphite : On adding dilute Sulphuric acid to a metallic Sulphite a **colourless gas** having **burning sulphur smell** evolves which turns acidified Potassium dichromate solution from **orange to green** and Potassium permanganate solution from **purple to colourless**, *i.e.*, it decolourizes.



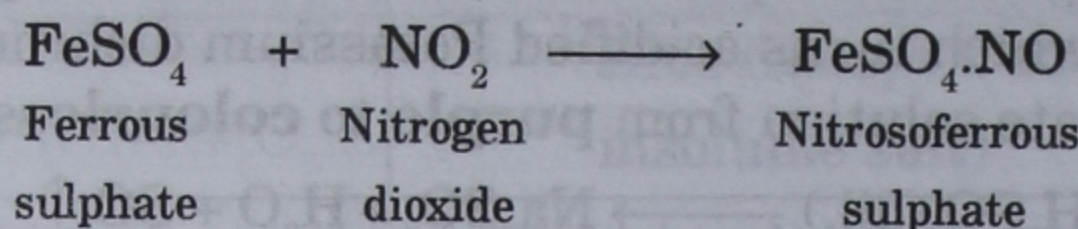
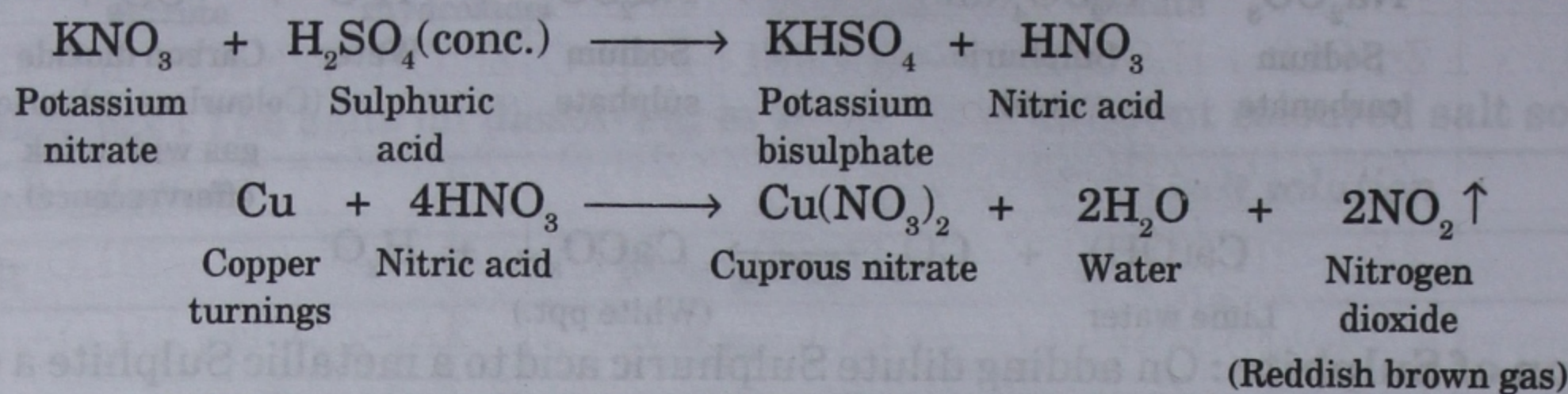
15. Detection of Sulphide : On adding dilute Sulphuric acid to metallic Sulphide a **colourless gas** having **rotten egg smell** evolves which turns lead acetate solution **black**.



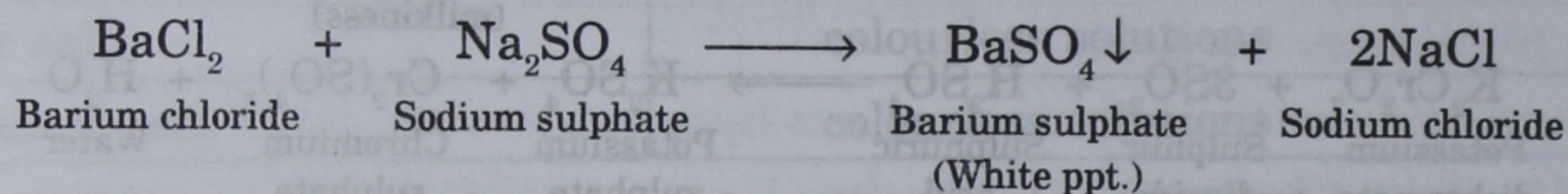
16. Detection of Chloride : On adding concentrated Sulphuric acid to metallic Chlorides a **colourless gas** having **pungent suffocating smell** which **fumes in moist air** evolves which gives **white ppt.** with silver nitrate solution which is **soluble** in excess of Ammonium hydroxide and **dense white fumes** with Ammonium hydroxide.



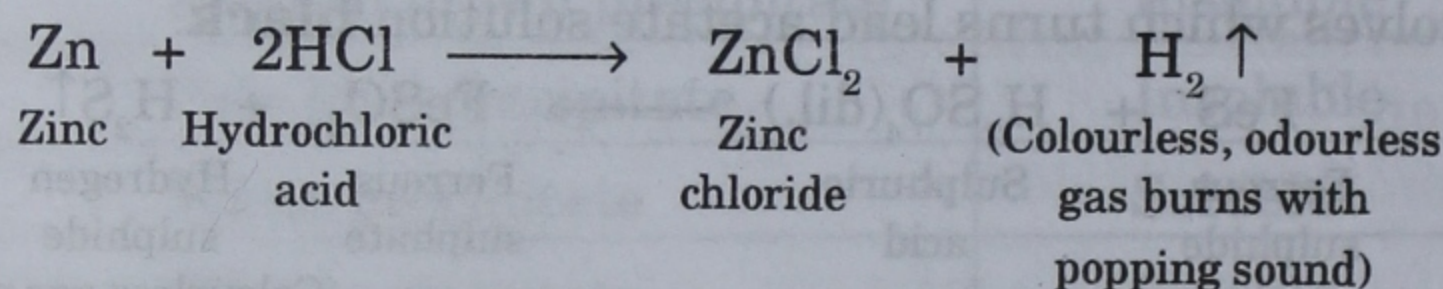
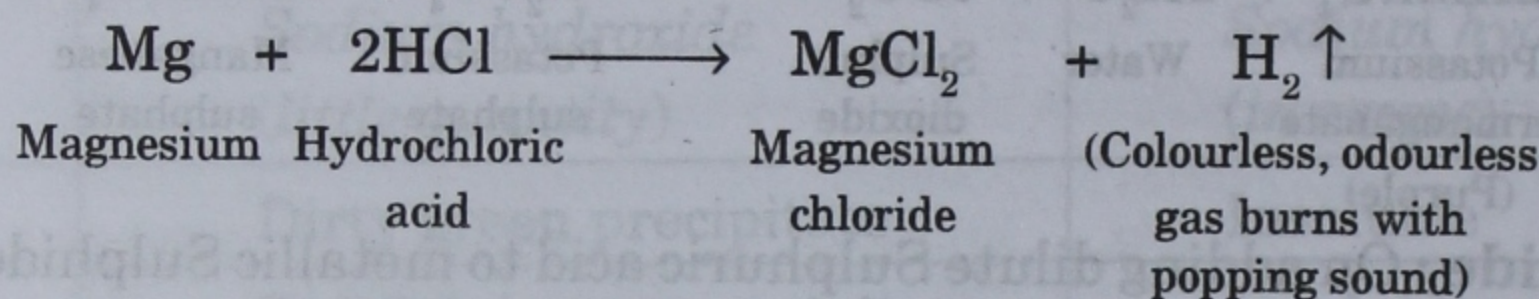
- 17. Detection of Nitrate :** On adding concentrated Sulphuric acid to metallic Nitrate in presence of Copper turnings and heated strongly a **reddish brown gas** having **pungent suffocating smell** evolves which turns freshly prepared acidified Ferrous sulphate solution **brown black**.



- 18. Detection of Sulphate :** To the salt solution of a soluble metallic Sulphate, Barium chloride solution is added, a **white precipitate** appears which is **insoluble** in all mineral acids.



- 19. Detection of Hydrogen :** On reaction of active metals with dilute acids a **colourless and odourless gas** evolves which burns with a **popping sound**.



- 20.** The colour, odour of the gases can be summarized as follows :

Name of the gas evolved	Colour of the gas	Odour of the gas
(i) Carbon dioxide	Colourless	Odourless
(ii) Sulphur dioxide	Colourless	Burning sulphur smell
(iii) Hydrogen sulphide	Colourless	Rotten egg smell
(iv) Hydrogen chloride gas	Colourless gas fumes in moist air	Pungent suffocating smell
(v) Nitrogen dioxide	Reddish brown	Pungent suffocating
(vi) Hydrogen	Colourless	Odourless
(vii) Ammonia	Colourless	Pungent irritating

- 21. Metals like sodium, potassium and calcium are not used for the preparation of hydrogen in laboratory as the reaction is highly vigorous and explosive.**

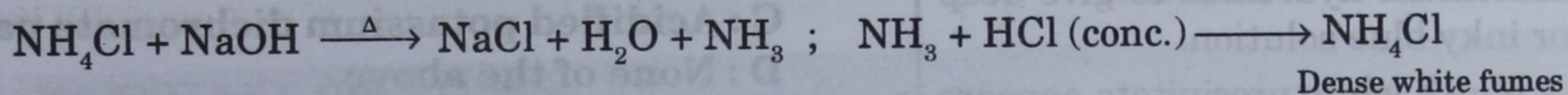
Amphoteric Nature of Metals, their Oxides and their Hydroxides

Metals / Oxides / Hydroxides	Acidic nature	Alkaline nature
Zn	$\text{Zn} + \text{H}_2\text{SO}_4(\text{dil.}) \longrightarrow \text{ZnSO}_4 + \text{H}_2 \uparrow$ $\text{Zn} + 2\text{HCl}(\text{dil.}) \longrightarrow \text{ZnCl}_2 + \text{H}_2 \uparrow$	$\text{Zn} + 2\text{NaOH}(\text{dil.}) \xrightarrow{\Delta} \text{Na}_2\text{ZnO}_2 + \text{H}_2 \uparrow$ $\text{Zn} + 2\text{KOH}(\text{dil.}) \xrightarrow{\Delta} \text{K}_2\text{ZnO}_2 + \text{H}_2 \uparrow$

ZnO	$\text{ZnO} + \text{H}_2\text{SO}_4(\text{dil.}) \longrightarrow \text{ZnSO}_4 + \text{H}_2\text{O}$ $\text{ZnO} + 2\text{HCl}(\text{dil.}) \longrightarrow \text{ZnCl}_2 + \text{H}_2\text{O}$	$\text{ZnO} + 2\text{NaOH}(\text{dil.}) \xrightarrow{\Delta} \text{Na}_2\text{ZnO}_2 + \text{H}_2\text{O}$ $\text{ZnO} + 2\text{KOH}(\text{dil.}) \xrightarrow{\Delta} \text{K}_2\text{ZnO}_2 + \text{H}_2\text{O}$
Zn(OH) ₂	$\text{Zn}(\text{OH})_2 + \text{H}_2\text{SO}_4(\text{dil.}) \longrightarrow \text{ZnSO}_4 + 2\text{H}_2\text{O}$ $\text{Zn}(\text{OH})_2 + 2\text{HCl}(\text{dil.}) \longrightarrow \text{ZnCl}_2 + 2\text{H}_2\text{O}$	$\text{Zn}(\text{OH})_2 + 2\text{NaOH}(\text{dil.}) \xrightarrow{\Delta} \text{Na}_2\text{ZnO}_2 + 2\text{H}_2\text{O}$ $\text{Zn}(\text{OH})_2 + 2\text{KOH}(\text{dil.}) \xrightarrow{\Delta} \text{K}_2\text{ZnO}_2 + 2\text{H}_2\text{O}$
Al	$2\text{Al} + 3\text{H}_2\text{SO}_4(\text{dil.}) \longrightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{H}_2\uparrow$ $2\text{Al} + 6\text{HCl}(\text{dil.}) \longrightarrow 2\text{AlCl}_3 + 3\text{H}_2\uparrow$	$2\text{Al} + 2\text{NaOH} + 2\text{H}_2\text{O} \xrightarrow{\Delta} 2\text{NaAlO}_2 + 3\text{H}_2\uparrow$ $2\text{Al} + 2\text{KOH} + 2\text{H}_2\text{O} \xrightarrow{\Delta} 2\text{KAlO}_2 + 3\text{H}_2\uparrow$
Al ₂ O ₃	$\text{Al}_2\text{O}_3 + 3\text{H}_2\text{SO}_4(\text{dil.}) \longrightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{H}_2\text{O}$ $\text{Al}_2\text{O}_3 + 6\text{HCl}(\text{dil.}) \longrightarrow 2\text{AlCl}_3 + 3\text{H}_2\uparrow$	$\text{Al}_2\text{O}_3 + 2\text{NaOH}(\text{dil.}) \xrightarrow{\Delta} 2\text{NaAlO}_2 + \text{H}_2\text{O}$ $\text{Al}_2\text{O}_3 + 2\text{KOH}(\text{dil.}) \xrightarrow{\Delta} 2\text{KAlO}_2 + \text{H}_2\text{O}$
Al(OH) ₃	$2\text{Al}(\text{OH})_3 + 3\text{H}_2\text{SO}_4(\text{dil.}) \longrightarrow \text{Al}_2(\text{SO}_4)_3 + 6\text{H}_2\text{O}$ $\text{Al}(\text{OH})_3 + 3\text{HCl}(\text{dil.}) \longrightarrow \text{AlCl}_3 + 3\text{H}_2\text{O}$	$\text{Al}(\text{OH})_3 + \text{NaOH}(\text{dil.}) \xrightarrow{\Delta} \text{NaAlO}_2 + 2\text{H}_2\text{O}$ $\text{Al}(\text{OH})_3 + \text{KOH}(\text{dil.}) \xrightarrow{\Delta} \text{KAlO}_2 + 2\text{H}_2\text{O}$

22. Reaction of sodium hydroxide on Ammonium salts :

Ammonium chloride on heating with sodium hydroxide produces colourless gas having pungent irritating odour which gives dense white fumes with concentrated HCl and turns Nessler's reagent brown.



PREVIOUS YEARS' QUESTIONS

2012

Q1. A gas which turns acidified potassium dichromate clear green. [1]

Ans. Sulphur dioxide.

Q2. State one observation for each of the following :

(i) Excess ammonium hydroxide solution is added to lead nitrate solution.

(ii) Sodium hydroxide solution is added to ferric chloride solution at first a little and then in excess. [2]

Ans. (i) White precipitate appears which remains insoluble in excess of ammonium hydroxide.

(ii) Reddish brown precipitate appears which is insoluble in excess of sodium hydroxide solution.

Q3. (a) Identify the anion present in the following compounds :

(i) Compound X on heating with copper turnings and concentrated sulphuric acid liberates a reddish brown gas.

(ii) When a solution of compound Y is treated with silver nitrate solution a white precipitate is obtained which is soluble in excess of ammonium hydroxide solution.

(iii) Compound Z which on reacting with dilute sulphuric acid liberates a gas which turns lime water milky, but the gas has no effect on acidified potassium dichromate solution.

(iv) Compound L on reacting with Barium chloride solution gives a white precipitate insoluble in dilute hydrochloric acid or dilute nitric acid. [4]

(b) State one chemical test between each of the following pairs :

(i) Sodium carbonate and Sodium sulphite

(ii) Ferrous nitrate and Lead nitrate

(iii) Manganese dioxide and Copper (II) oxide [3]

Ans. (a) (i) NO_3^{-1} (ii) Cl^{-1} (iii) CO_3^{-2} (iv) SO_4^{-2}

(b) (i) Add dilute hydrochloric acid to both compounds

Sodium carbonate – CO_2 is obtained
Sodium sulphate – SO_2 is obtained

(ii) Add sodium hydroxide or Ammonium hydroxide solution to both the compounds.

Ferrous nitrate — dirty green ppt appears which is insoluble in excess.

Lead nitrate — white precipitate appears which is insoluble in excess.

(iii) Add concentrated hydrochloric acid to both the compounds.

Manganese oxide — Brown coloured solution is formed.

Copper oxide — Blue coloured solution is formed.

2011

Q1. What do you observe when ammonium hydroxide is first added in a small quantity and then in excess to a solution of copper sulphate ? [1]

Ans. Pale blue precipitate is formed which dissolves in excess of ammonium hydroxide to give deep blue solution or inky blue solution.

A pale blue or a bluish white precipitate appears which dissolves in excess to give deep blue solution or inky blue solution or prussian blue solution.

Q2. Sodium hydroxide solution is added to the solutions containing the ions mentioned in list X. List Y gives the details of the precipitate. Match the ions with their coloured precipitates. [3]

List X	List Y
(i) Pb^{+2}	(A) Reddish brown
(ii) Fe^{+2}	(B) White insoluble in excess
(iii) Zn^{+2}	(C) Dirty green
(iv) Fe^{3+}	(D) White soluble in excess
(v) Cu^{+2}	(E) White soluble in excess
(vi) Ca^{+2}	(F) Blue

Ans. (i) D or E

(ii) C

(iii) D or E

(iv) A

(v) F

(vi) B

2009

Q1. Match the substance listed below with appropriate description : [1]

A : Sulphur

B : Silver chloride

C : Hydrogen chloride

D : Copper(II) sulphate

E : Graphite

A compound which is insoluble in cold water but soluble in excess of ammonia solution.

Ans. B : Silver chloride

Q2. Select the correct answer from the choices A, B, C and D which are given. [1]

(i) The metal oxide which can react with acid as well as alkali is

A : Silver oxide

B : Copper (II) oxide

C : Aluminium oxide

D : Calcium oxide

Ans. C : Aluminium oxide

(ii) Carbon dioxide and sulphur dioxide gas can be distinguished by using [1]

A : Moist blue litmus paper

B : Lime water

C : Acidified potassium dichromate paper

D : None of the above

Ans. C : Acidified potassium dichromate paper

Q3. Identify the substances P, Q and R in each case based on the information given below :

(i) The deliquescent salt 'P' turns yellow on dissolving in water, and gives a reddish brown precipitate with sodium hydroxide solution.

(ii) The white crystalline solid 'Q' is soluble in water. It liberates a pungent smelling gas when heated with sodium hydroxide solution.

(iii) The pale green solid 'R' turns reddish brown on heating. Its aqueous solution gives a white precipitate with Barium chloride solution. The precipitate is insoluble in mineral acids. [3]

Ans. (i) Ferric chloride

(ii) Ammonium chloride

(iii) Ferrous sulphate

Q4. Give one chemical test to distinguish between the following pairs of compounds.

(i) Zinc sulphate and zinc chloride solution.

(ii) Iron (II) chloride solution and Iron (III) chloride solution.

(iii) Calcium nitrate solution and calcium chloride solution [3]

Ans. (i) By adding barium chloride solution

On adding Barium chloride solution to zinc sulphate white precipitate appears which is insoluble in all the mineral acids whereas in the case of zinc chloride there is no visible reaction.

2008

(ii) By adding ammonium hydroxide solution

On adding Ammonium hydroxide to Iron (II) chloride solution a dirty green precipitate appears which changes to reddish brown after sometime.

On adding ammonium hydroxide to Iron (III) chloride solution reddish brown precipitate appears which is insoluble in excess.

(iii) By adding silver nitrate solution

On adding silver nitrate solution to both the solutions the following changes are observed
Calcium nitrate — no visible reaction

Calcium chloride — white precipitate appears which is soluble in excess of ammonium hydroxide.

Q1. Select the correct answer from the choices A, B, C, D which are given below.

The salt which in solution gives a pale green precipitate with sodium hydroxide solution and a white precipitate with barium chloride solution is : [1]

A : Iron(III) sulphate

B : Iron(II) sulphate

C : Iron(II) chloride

D : Iron(III) chloride

Ans. B : Iron (II) sulphate

2006

Q1. What do you observe when excess of ammonia is passed through an aqueous solution of Lead nitrate ? [1]

Ans. White precipitate appears which is insoluble in excess ammonia.

IMPORTANT QUESTIONS

Q1. Three test tubes contain Calcium nitrate solution, Zinc nitrate solution and Lead nitrate solution respectively. Each solution is divided into two portions (a) and (b). Describe the effect of :

(a) Adding Sodium hydroxide to each portion in turn till it is in excess.

(b) Adding Ammonium hydroxide to each portion in turn till it is in excess.

Ans. (a) Sodium Hydroxide

Salt solution	In small amount	In excess
Calcium nitrate	White precipitate	Insoluble
Zinc nitrate	White precipitate	Soluble
Lead nitrate	White precipitate	Soluble

(b) Ammonium Hydroxide

Salt solution	In small amount	In excess
Calcium nitrate	No visible reaction	No change
Zinc nitrate	White precipitate	Soluble
Lead nitrate	White precipitate	Insoluble

Q2. What do you see when :

Sodium hydroxide solution is added to Zinc sulphate till it is in excess.

Ans. On adding Sodium hydroxide solution to Zinc sulphate solution, a white precipitate is formed which is soluble in excess of Sodium hydroxide.

Q3. You are given the three white powders Calcium carbonate, Lead carbonate and Zinc carbonate. Describe the tests you would carry out in solution to identify the metal in each of the above compounds. Indicate clearly how you would prepare the solutions for the tests.

Ans. Calcium carbonate dissolves in dilute Nitric acid. To the clear solution, when Ammonium hydroxide is added, there is no visible reaction. Lead carbonate dissolves in dilute Nitric acid. To the clear solution when Ammonium hydroxide is added a white precipitate is formed which is insoluble in excess. Zinc carbonate dissolves in dilute Nitric acid. To the clear solution, when Ammonium hydroxide is added, a white precipitate is formed which is soluble in excess.

Q4. Write the equation for the following reaction :

Copper sulphate solution is added to Sodium hydroxide solution.

Ans. $\text{CuSO}_4 + 2\text{NaOH} \longrightarrow \text{Cu(OH)}_2 + \text{Na}_2\text{SO}_4$

Q5. (a) Sodium hydroxide solution is added to solution 'A'. A white precipitate is formed which is insoluble in excess of Sodium hydroxide solution. What is the metal ion present in solution 'A' ?

- (b) When Ammonium hydroxide is added to solution 'B' a pale blue precipitate is formed. This pale blue precipitate dissolves in excess of Ammonium hydroxide giving an inky blue solution. What is the cation present in solution 'B'? What is the probable colour of solution 'B'?

Ans. (a) Calcium ion or Ca^{2+}

(b) Copper ion or Cu^{2+}

The colour of solution 'B' is blue.

- Q6. Using Sodium hydroxide solution, how would you distinguish?

(a) Zinc nitrate solution and Calcium nitrate solution.

(b) Iron(II) chloride from Iron(III) chloride.

(c) Lead hydroxide from Magnesium hydroxide.

Ans. (a) Sodium hydroxide solution, when added to Zinc nitrate solution, a white precipitate is formed which is soluble in excess. On adding Sodium hydroxide solution to Calcium nitrate, a white precipitate is formed which is insoluble in excess.

(b) Sodium hydroxide solution, when added to Iron(II) chloride, dirty green precipitate is formed which changes to reddish brown after sometime. Sodium hydroxide solution, when added to Iron(III) chloride, a reddish brown precipitate is formed.

(c) Sodium hydroxide, when added to Lead hydroxide, dissolves it whereas Sodium hydroxide, when added to Magnesium hydroxide, there is no visible reaction, i.e., Magnesium hydroxide remains insoluble.

- Q7. How does Ammonium hydroxide help in distinguish between

(a) Iron(II) chloride and Iron(III) chloride,

(b) Zinc nitrate and Lead nitrate,

(c) Lead hydroxide and Zinc hydroxide?

Ans. (a) Iron(II) chloride, on reaction with Ammonium hydroxide, a dirty green precipitate is formed which changes to reddish brown. Ammonium hydroxide, when reacts with Iron(III) chloride, a reddish brown precipitate is formed.

(b) Zinc nitrate solution, on reaction with Ammonium hydroxide, produces a white precipitate which is soluble in excess.

Lead nitrate solution, on reaction with

Ammonium hydroxide, produces a white precipitate which is insoluble in excess.

(c) Lead hydroxide remains insoluble in Ammonium hydroxide whereas Zinc hydroxide dissolves in Ammonium hydroxide.

- Q8. What are the colour of the precipitates when Ammonium hydroxide is added to the following solutions?

(a) Iron(II) chloride

(b) Iron(III) chloride

(c) Lead nitrate

(d) Zinc nitrate

(e) Copper nitrate

Ans. (a) Dirty green precipitate which changes to reddish brown.

(b) Reddish brown precipitate.

(c) White precipitate.

(d) White precipitate.

(e) Bluish white precipitate.

- Q9. Write balanced chemical equations for the following:

(a) Sodium hydroxide is added to Copper sulphate solution.

(b) Ammonium hydroxide is added to Iron(III) chloride solution.

(c) Sodium hydroxide is added to Iron(II) chloride solution.

(d) Sodium hydroxide is added to Calcium nitrate.

(e) Sodium hydroxide solution is added to Zinc sulphate first a little then in excess.

Ans. (a) $\text{CuSO}_4 + 2\text{NaOH} \longrightarrow \text{Cu(OH)}_2 + \text{Na}_2\text{SO}_4$

(b) $3\text{NH}_4\text{OH} + \text{FeCl}_3 \longrightarrow \text{Fe(OH)}_3 + 3\text{NH}_4\text{Cl}$

(c) $2\text{NaOH} + \text{FeCl}_2 \longrightarrow \text{Fe(OH)}_2 + 2\text{NaCl}$

(d) $\text{Ca(NO}_3)_2 + 2\text{NaOH} \longrightarrow \text{Ca(OH)}_2 + 2\text{NaNO}_3$

(e) $\text{ZnSO}_4 + 2\text{NaOH} \longrightarrow \text{Zn(OH)}_2 + \text{Na}_2\text{SO}_4$

$\text{Zn(OH)}_2 + 2\text{NaOH} \longrightarrow \text{Na}_2\text{ZnO}_2 + 2\text{H}_2\text{O}$

- Q10. What do you observe when

(a) Ammonium hydroxide is added to Copper sulphate solution first a little then in excess?

(b) Sodium hydroxide solution is added to Zinc sulphate solution first a little then in excess?

(c) Calcium nitrate is added to Sodium hydroxide solution?

(d) Sodium hydroxide solution is added to Iron(III) chloride solution?

(e) Ammonium hydroxide solution is added to Lead nitrate solution first a little then in excess ?

- ns. (a) On adding Ammonium hydroxide drop by drop, a bluish white precipitate is formed which dissolves in excess of Ammonium hydroxide to give deep blue solution or inky blue solution or prussian blue solution.
 (b) A white precipitate is formed which is soluble in excess.
 (c) A white precipitate is formed which is insoluble in excess.
 (d) A reddish brown precipitate is formed.
 (e) A white precipitate is formed which is insoluble in excess.

Q11. Identify the cation in each of the following case :

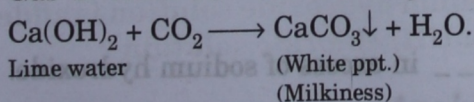
- (a) Sodium hydroxide solution when added to the solution 'A' gives reddish brown precipitate.
 (b) Ammonium hydroxide solution when added to the solution 'B' gives white precipitate which dissolves in excess.
 (c) Sodium hydroxide solution when added to solution 'C' gives bluish white precipitate which is insoluble in excess.
 (d) Ammonium hydroxide solution when added to solution 'D' gives dirty green precipitate which changes to reddish brown after sometime.
 (e) Ammonium hydroxide solution when added to the solution 'E' gives bluish white precipitate which dissolves in excess to give deep blue solution.

- Ans. (a) Ferric, Fe^{3+}
 (b) Zinc ion, Zn^{2+}
 (c) Copper ion, Cu^{2+}
 (d) Ferrous ion, Fe^{2+}
 (e) Cupric ion, Cu^{2+}

Q12. Compound 'A' on reaction with dilute hydrochloric acid produces a colourless, odourless gas 'B' with brisk effervescence.

- (i) Identify gas 'B'.
 (ii) Identify anion in compound 'A'.
 (iii) Give confirmatory test for the gas 'B'.

- Ans. (i) Gas 'B' is Carbon dioxide.
 (ii) Carbonate; CO_3^{2-} .
 (iii) Gas 'B' turns lime water milky.

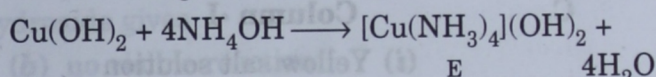
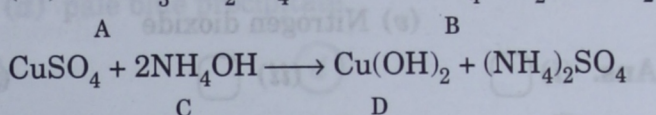
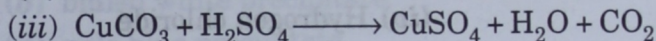


Q13. Green coloured amorphous salt 'A' on reaction with dilute sulphuric acid produces a blue coloured solution 'B'. The blue coloured solution on treatment with alkali 'C' produces pale blue precipitate 'D' and on adding excess of 'C' the precipitate 'D' dissolves to give a deep blue solution 'E'. In this context answer the following questions.

- (i) Identify A, B, C, D and E.
 (ii) Is 'A' soluble in water ?
 (iii) Write all equations involved in the above reactions.

- Ans. (i) A — Copper carbonate
 B — Copper sulphate
 C — Ammonium hydroxide
 D — Copper hydroxide
 E — Tetraamine copper hydroxide

(ii) 'A' is insoluble in water.



Q14. From the list of the substances given below choose the substance which fits into the description given below :

Ammonium chloride, calcium hydroxide, lime water, Ammonia, concentrated hydrochloric acid, Zinc carbonate, carbon dioxide, Concentrated sulphuric acid, copper carbonate

- (i) Substance 'A' is formed when water is added to calcium oxide.
 (ii) Substance 'A' on reaction with substance 'B' produces alkaline gas 'C'
 (iii) Alkaline gas 'C' on reaction with 'D' produces dense white fumes.
 (iv) Substance 'E' on heating alone produces acidic gas 'F' and a yellow residue is left behind.
 (v) When 'F' is passed through 'G', turbidity appears

- Ans. (i) A — Calcium hydroxide,
 (ii) B — Ammonium chloride, C — Ammonia
 (iii) D — Concentrated hydrochloric acid
 (iv) E — Zinc carbonate, F — Carbon dioxide
 (v) G — Lime water



Let's Recall

Fill Your Answer in the Space Given for Each Question :

Q1. Match the following :

A. Column -I

- (i) Ferric hydroxide
- (ii) Ferrous hydroxide
- (iii) Copper hydroxide
- (iv) Zinc hydroxide
- (v) Lead hydroxide

Ans. (i)

(ii)

(iii)

Column-II

- (a) White precipitate soluble in NH_4OH
- (b) Pale blue precipitate
- (c) Reddish brown precipitate
- (d) White precipitate insoluble in NH_4OH
- (e) Dirty green precipitate

(iv)

(v)

B. Column -I

- (i) Carbon dioxide
- (ii) Sulphur dioxide
- (iii) Hydrogen sulphide
- (iv) Hydrogen chloride
- (v) Nitrogen dioxide

Ans. (i)

(ii)

(iii)

(iv)

(v)

Column-II

- (a) Burning sulphur smell
- (b) Colourless and odourless gas
- (c) Reddish brown coloured
- (d) Rotten egg smell
- (e) Colourless gas fumes in moisture

C. Column -I

- (i) Yellow salt solution
- (ii) Pale green salt solution
- (iii) Blue salt solution
- (iv) A green coloured salt
- (v) Colourless solution

Ans. (i)

(ii)

(iii)

(iv)

(v)

Column-II

- (a) Zinc salt
- (b) Copper carbonate
- (c) Ferrous salt
- (d) Ferric salt
- (e) Cupric salt

Q2. Name the following :

- (i) Salt soluble in excess of ammonium hydroxide. _____
- (ii) A colourless gas which turns acidified potassium dichromate solution from orange to green.

- (iii) A metal which reacts vigorously with dilute acids to liberate hydrogen. _____
- (iv) A gas which turns lead acetate solution black. _____
- (v) Composition of brown black colour formed during the test of nitrogen dioxide. _____

Q3. State whether the following statements are True or False.

- (i) Lead hydroxide is soluble in sodium hydroxide.
- (ii) Lead hydroxide is soluble in ammonium hydroxide.
- (iii) Zinc hydroxide is insoluble in sodium hydroxide.
- (iv) Sulphate is detected by using dilute sulphuric acid.
- (v) Copper oxide reacts both with acid and alkali.

Q4. Fill in the blanks.

- (i) Ferric hydroxide is a _____ precipitate _____ in excess of sodium hydroxide.

- (ii) Copper hydroxide is a _____ precipitate _____ in excess of ammonium hydroxide.
 (iii) Zinc hydroxide is a _____ precipitate _____ in excess of sodium hydroxide.
 (iv) Calcium salts with ammonium hydroxide give _____ reaction.
 (v) Magnesium hydroxide is a _____ precipitate _____ in excess of ammonium hydroxide.

Q5. Each question has four options, out of which only one option is correct. Dark the bubble for correct answer.

(i) A solution which gives dirty green precipitate with sodium hydroxide likely to have

- (a) Zn^{2+} ions (b) Fe^{2+} ions
 (c) NH_4^+ ions (d) Cu^{2+} ions

Ans.

- (a) (b) (c) (d)

(ii) The salt solutions containing cupric ions are of

- (a) yellow colour (b) black colour
 (c) blue colour (d) colourless

Ans.

- (a) (b) (c) (d)

(iii) Cupric hydroxide is a

- (a) blue solution (b) bluish white precipitate
 (c) white precipitate (d) pale blue precipitate.

Ans.

- (a) (b) (c) (d)

(iv) Calcium nitrate on reaction with ammonium hydroxide gives

- (a) white precipitate (b) no visible reaction
 (c) green precipitate (d) None of these.

Ans.

- (a) (b) (c) (d)

(v) Sulphate ion (SO_4^{2-}) is detected by using

- (a) dilute sulphuric acid (b) concentrated sulphuric acid
 (c) Both of these (d) None of these

Ans.

- (a) (b) (c) (d)

Q6. Name the gas which fits into the description given below.

- (i) A colourless and odourless gas which turns lime water milky. _____
 (ii) A colourless gas having burning sulphur smell which turns lime water milky. _____
 (iii) A colourless gas having rotten egg smell. _____
 (iv) A colourless gas which fumes in moist air. _____
 (v) A reddish brown coloured gas having pungent suffocating smell. _____
 (vi) A gas which gives dense white fumes with ammonium hydroxide. _____
 (vii) A gas which turns freshly prepared acidified ferrous sulphate solution brown black.

 (viii) A gas which turns lead acetate solution black. _____
 (ix) A gas which decolourizes potassium permanganate solution. _____
 (x) A gas which burns with a popping sound. _____

ANSWERS

1. A. (i) c (ii) e (iii) b (iv) a (v) d
 B. (i) b (ii) a (iii) d (iv) e (v) c
 C. (i) d (ii) c (iii) e (iv) b (v) a
2. (i) zinc hydroxide (ii) sulphur dioxide (iii) sodium (iv) hydrogen sulphide
 (v) $\text{FeSO}_4 \cdot \text{NO}$
3. (i) True (ii) False (iii) False (iv) False (v) False
4. (i) reddish brown, insoluble (ii) bluish white, soluble
 (iii) white, soluble (iv) no (v) white, insoluble
5. (i) b (ii) c (iii) b (iv) b (v) d
6. (i) carbon dioxide (ii) sulphur dioxide (iii) hydrogen sulphide
 (iv) hydrogen chloride (v) nitrogen dioxide (vi) hydrogen chloride
 (vii) nitrogen dioxide (viii) hydrogen sulphide (ix) sulphur dioxide (x) hydrogen

SELF EVALUATION Test

Time : 30 minutes

Marks : 25

- Q1.** Why sulphur dioxide and carbon dioxide cannot be distinguished by using lime water ? 1
- Q2.** How does ammonium hydroxide solution help in distinguishing between Zinc nitrate and Magnesium nitrate ? 1
- Q3.** Name the anion present in each case. 3
- (i) On adding concentrated sulphuric acid to salt 'A' a colourless gas which fumes in moist air evolves and the gas gives dense white fumes with ammonium hydroxide.
- (ii) On adding concentrated sulphuric acid to salt 'B' a reddish brown coloured gas having pungent suffocating smell evolves.
- (iii) On adding dilute sulphuric acid to salt 'B' a colourless, odourless gas evolves with brisk effervescence which turns lime water milky.
- Q4.** Write balanced chemical equations for the following reactions : 5
- (i) Ammonium hydroxide is added to copper sulphate solution first a little and then in excess.
- (ii) Ammonium hydroxide is added to zinc nitrate solution first a little and then in excess.
- (iii) Sodium hydroxide is added to zinc chloride solution first a little and then in excess.
- (iv) Sodium hydroxide is added to lead nitrate solution first a little and then in excess.
- (v) Ammonium hydroxide is added to ferric chloride solution.
- (vi) Sulphur dioxide is passed through potassium permanganate solution.
- (vii) Sulphur dioxide is passed through acidified potassium dichromate solution.
- (viii) Hydrogen sulphide is passed through lead acetate solution.
- (ix) Carbon dioxide is passed through lime water.
- (x) Barium chloride solution is added to sodium sulphate solution.
- Q5.** Name the chemical compound found which is responsible for the following colours 5
- (i) Reddish from precipitate
- (ii) Dirty green precipitate
- (iii) Pale blue precipitate
- (iv) White precipitate soluble in excess of NH_4OH
- (v) White precipitate insoluble in excess of NH_4OH
- Q6.** Distinguish between the following pairs as directed : 10
- (i) Lead nitrate and zinc nitrate using ammonium hydroxide solution.
- (ii) Iron(II) chloride and iron(III) chloride using sodium hydroxide solution.
- (iii) Sodium sulphite and sodium sulphate using barium chloride solution.
- (iv) Sodium carbonate and sodium sulphite using dilute sulphuric acid.
- (v) Sodium nitrate and sodium chloride using silver nitrate solution.