

Analytical Chemistry—Use of Ammonium Hydroxide and Sodium Hydroxide

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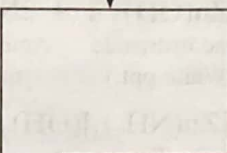
CHAPTER AT A GLANCE

Analytical chemistry: NaOH and NH₄OH

Colours of salts and their solutions

- Ferrous salt: Green
- Ferric salt: Yellow
- Cupric salt: Blue except CuCO₃ which is green
- Lead salt: Colourless
- Zinc salt: Colourless
- Calcium salt: Colourless

Action of NaOH on certain salt solutions



Action of NH₄OH on certain salt solutions

Action of Alkalies

When NaOH is in little

- Dirty green ppt ←
- Reddish brown ppt ←
- Pale blue ppt ←
- White ppt ←
- White ppt ←
- White ppt ←

- Ferrous salt
- Ferric salt
- Cupric salt
- Lead salt
- Zinc salt
- Calcium salt

When NaOH is in excess

- • Insoluble
- • Insoluble
- • Insoluble
- • Soluble
- • Soluble
- • Soluble

When NH₄OH is in little quantity

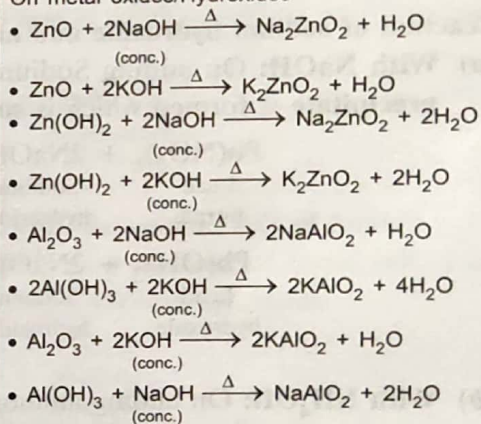
- Dirty green ppt ←
- Reddish brown ppt ←
- Pale blue ppt ←
- White ppt
- White ppt
- No visible reaction

- Ferrous salt
- Ferric salt
- Cupric salt
- Lead salt
- Zinc salt
- Calcium salt

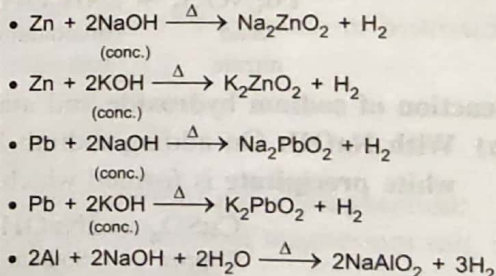
When NH₄OH is in excess

- • Insoluble
- • Insoluble
- • Soluble (deep blue solution)
- • Insoluble
- • Soluble
- • No visible reaction

On metal oxides/Hydroxides



On certain metals

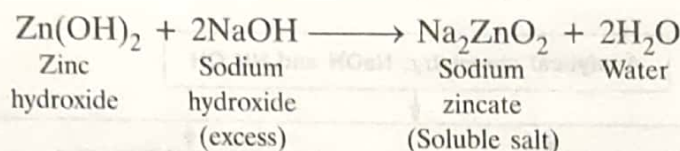
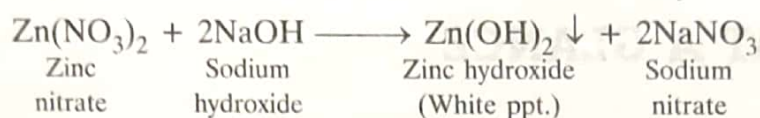


IMPORTANT TERMS, DEFINITIONS AND REACTIONS

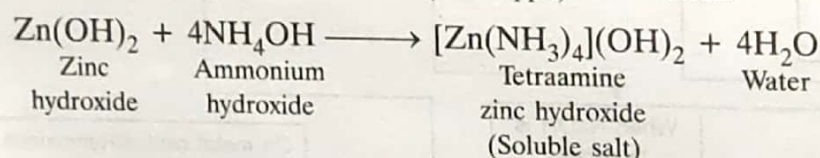
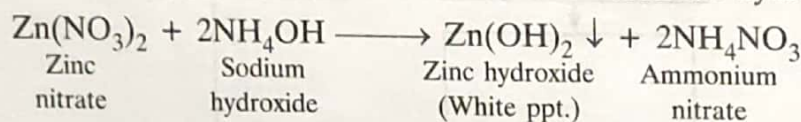
1. Alkalis, i.e. sodium hydroxide and ammonium hydroxide react with the soluble salts of metal to precipitate different coloured hydroxides.

2. Reaction of Sodium hydroxide and Ammonium hydroxide with the 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.

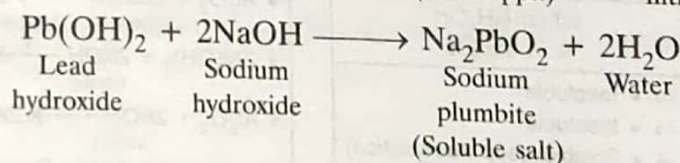
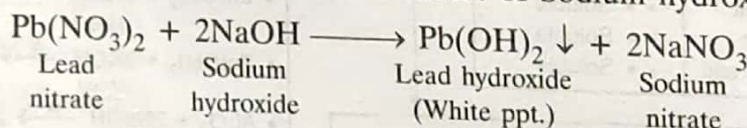


(b) With NH₄OH: On adding ammonium hydroxide drop by drop to a solution of zinc salt, a white precipitate is formed which is soluble in excess of ammonium hydroxide.

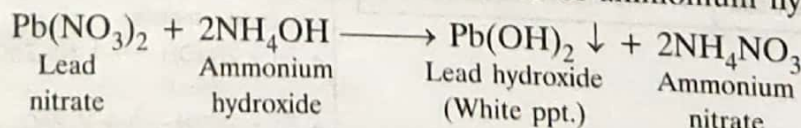


3. Reaction of sodium hydroxide and ammonium hydroxide with the soluble salt of lead:

(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.

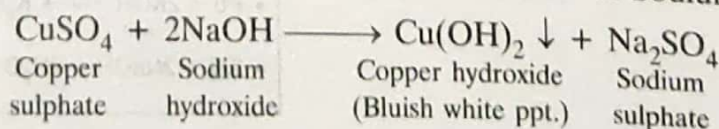


(b) With NH₄OH: On adding ammonium hydroxide drop by drop to a solution of lead salt, a white precipitate is formed which is insoluble in excess of ammonium hydroxide.

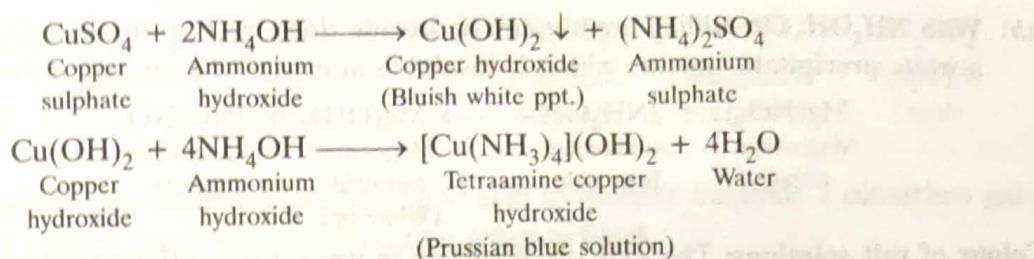


4. Reaction of sodium hydroxide and ammonium hydroxide with the soluble salt of copper:

(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.

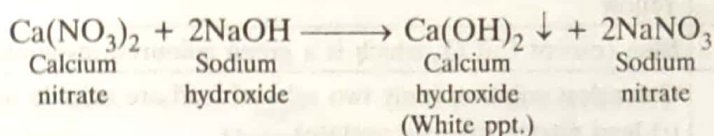


(b) With NH₄OH: On adding ammonium hydroxide drop by drop to a solution of copper salt, a pale blue or bluish white precipitate is formed which dissolves in excess of ammonium hydroxide to give deep blue or inky blue or prussian blue solution.



5. Reaction of sodium hydroxide and ammonium hydroxide with the soluble salt of calcium:

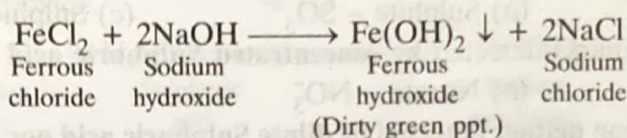
- (a) **With NaOH:** On adding sodium hydroxide drop by drop to a solution of calcium salt, a **white precipitate** is formed which is **insoluble** in excess of sodium hydroxide.



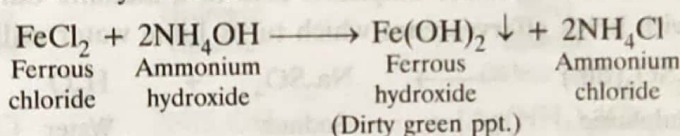
- (b) **With NH₄OH:** No visible reaction.

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.

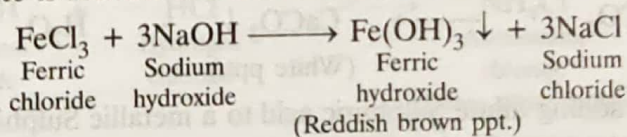


- (b) **With NH₄OH:** On adding ammonium hydroxide drop by drop to a solution of ferrous salt, a **dirty green precipitate** is formed which turns **reddish brown** after sometime and is **insoluble** in excess of ammonium hydroxide.

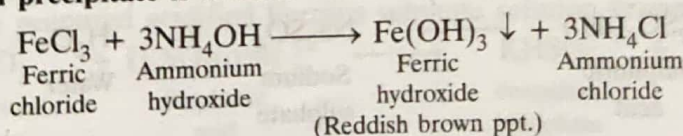


7. Reaction of sodium hydroxide and ammonium hydroxide with the soluble salt of ferric:

- (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.

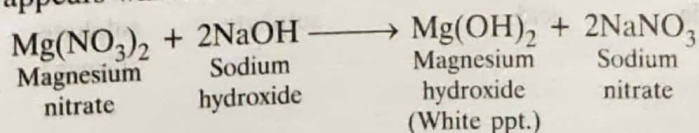


- (b) **With NH₄OH:** On adding ammonium hydroxide drop by drop to a solution of ferric salt, a **reddish brown precipitate** is formed which is **insoluble** in excess of ammonium hydroxide.

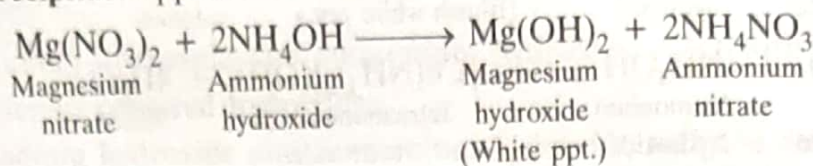


8. Reaction of Sodium hydroxide and Ammonium hydroxide with soluble salt of Magnesium:

- (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.



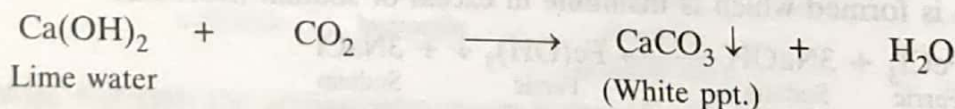
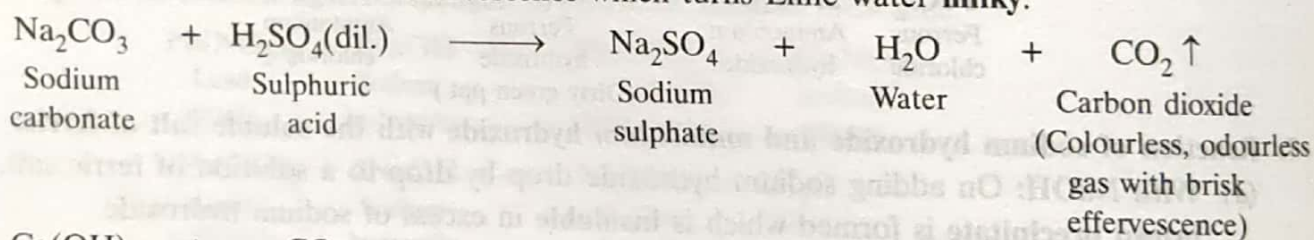
9. **Colour of salt solutions:** The salts on dissolving in water form different coloured salt solutions.

Name of the salt	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

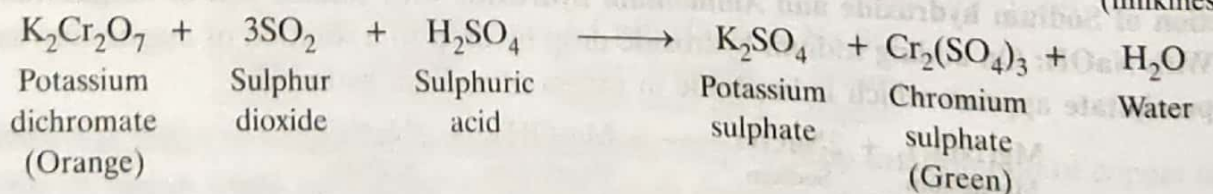
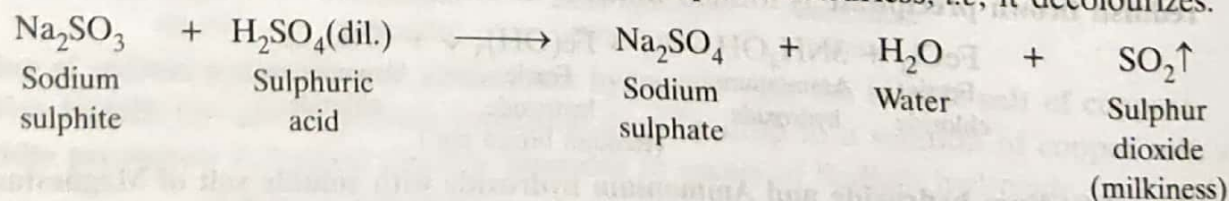
10. **The acid radicals are divided in three main categories:**

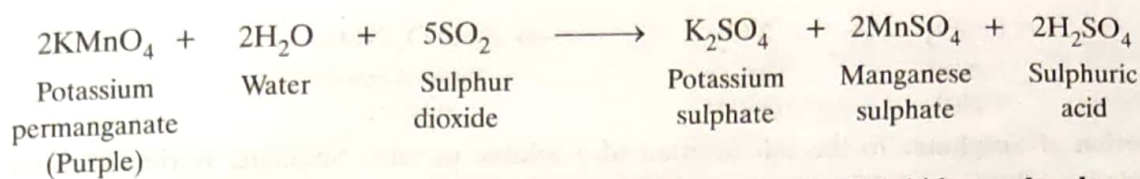
- The acid radicals or anions detected by **dilute Sulphuric acid** are
 - Carbonate – CO_3^{2-}
 - Sulphite – SO_3^{2-}
 - Sulphide – S^{2-}
- The acid radicals or anions detected by **concentrated Sulphuric acid** are
 - Chloride – Cl^-
 - Nitrate – NO_3^-
- The acid radical or anion **neither** detected by **dilute Sulphuric acid** nor by **concentrated Sulphuric acid** is
 - Sulphate – SO_4^{2-}

11. **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**.

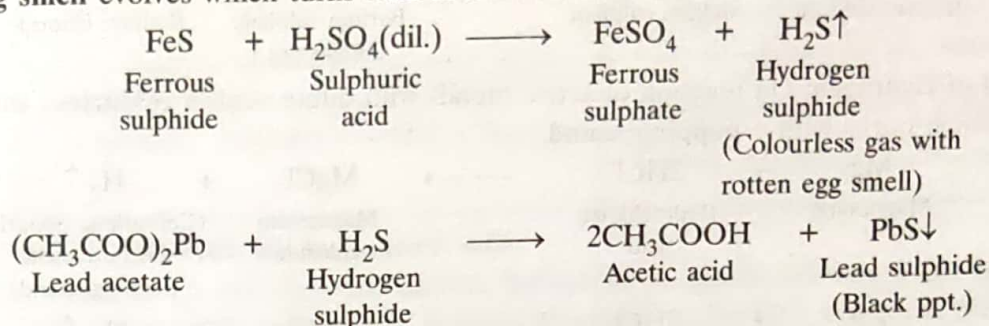


12. **Detection of Sulphite:** On adding dilute Sulphuric acid to a metallic Sulphite a **colourless gas** having **burning sulphur smell** evolves which turns acidified Potassium dichromate solution from **orange** to **green** and Potassium permanganate solution from **purple** to **colourless**, i.e.,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

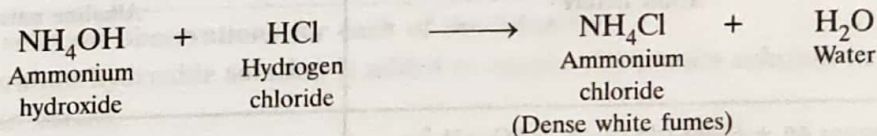
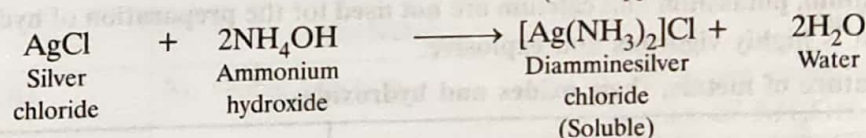
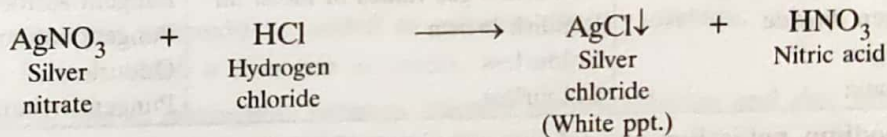
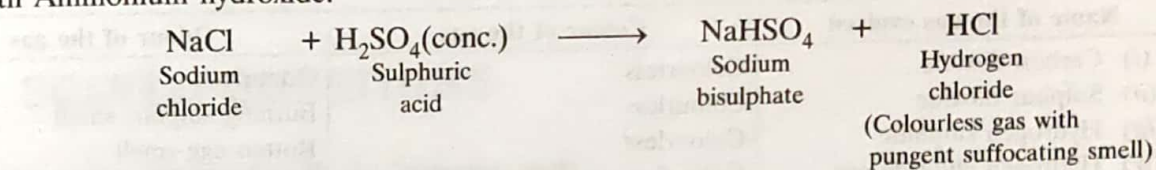




13. **Detection of Sulphide:** On adding dilute Sulphuric acid to metallic Sulphide a **colourless gas** having **rotten egg smell** evolves which turns lead acetate solution **black**.



14. **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.



15. **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**.

