Class – 10

Sub. – Chemistry

Chapter – 4

Analytical Chemistry

Determination of chemical components of a substance is called analysis of that substance.The analysis can be either Quantitative or Qualitative.

Quantitative analysis involves the determination of the composition of a mixture, whereas, qualitative analysis involves identification of an unknown substance in a mixture.

Identification of unknown substance during the qualitative analysis is done with the help of reagents. Alkalis are the important laboratory reagents.A base that is soluble in water is called an alkali. All alkalis are bases, but all bases are not alkalies.

Example:
Potassium hydroxide, sodium hydroxide, calcium hydroxide and ammonium hydroxide…etc
The most commonly used reagents are sodium hydroxide which is a strong alkali and ammonium hydroxide which is a weak alkali. These alkalis react with the solution of metal salts to form precipitates of different coloured hydroxides, which may be soluble or insoluble in excess of these alkalis.

Action of sodium hydroxide on metal salts

Salts	Salt solution + Alkali – metal + salt hydroxide (ppt)	Solubility of ppt in excess of alkali

Calcium salts Ca2+	Ca(NO3)2+2NaOH→Ca(OH)2↓+2NaNO3	Sparingly soluble
Ferrous salts[Fe2+]	FeSO4+2NaOH→Fe(OH)2↓+Na2SO4	Insoluble
Ferric salt [Fe3+]	FeCl3+3NaOH→Fe(OH)3↓+3NaCl	Insoluble
Copper salts [Cu2+]	CuSO4+2NaOH→Cu(OH)2↓+Na2SO4	Insoluble
Zinc Salts [Zn2+]	ZnSO4+2NaOH→Zn(OH)2↓+Na2SO4 Zn(OH)2+2NaOH(excess)→Na2ZnO2+2H2O	Soluble
Lead salts [Pb2+]	Pb(NO3)2+2NaOH→Pb(OH)2↓+2NaNO3	Soluble
Ammonium SaltsNH4+	NH4Cl+NaOH⟶NaCl+H2O+NH3 (NH4)2SO4+2NaOH⟶Na2SO4+2H2O+2NH3	

Action of ammonium hydroxide on metal salts

Salt	Salt solution + ammonium hydroxide à metal hydroxide + salt	Solubility of ppt in excess of NH4OH
Calcium salts	No precipitation of Ca(OH)2 even when NH4OH is added in excess	

Ferrous salts [Fe2+]	FeSO4+2NH4OH→Fe(OH)2↓+(NH4)2SO4	Insoluble
Ferric salts [Fe^{3+}]	FeCl3+3NH4OH→Fe(OH)3↓+(NH4)Cl Fe2(SO4)3+6NH4OH→2Fe(OH)3↓+3(NH4)2SO4	Insoluble
Copper (II) salts [Cu2+]	CuSO4+2NH4O→Cu(OH)2↓+(NH4)2SO4 Cu(OH)2+(NH4)2SO4+NH4OH→[Cu(NH3)4]SO4+4H2O Test to detect Cu2+ ion	Soluble
Zinc salts [Zn2+]	ZnSO4+2NH4OH→Zn(OH)2↓+(NH4)2SO4 Zn(OH)2↓+(NH4)2SO4+2NH4OH→[Zn(NH3)4]SO4 ZnCl2+2NH4OH→Zn(OH)2↓+2NH4Cl	Soluble

Amphoteric oxides

Metal oxides which react with both acids as well as bases to produce salts and water are known as amphoteric oxides. Amphoteric oxides include lead oxide and zinc oxide, among many others.

Below are the action of zinc and aluminium oxides and hydroxides on sodium hydroxide and potassium hydroxide: