**The Analytical Classification of the Metal Ions (Cations)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Groups** | **Ions of Groups** | **Group reagent (precipitating agent)** | **Formula of precipitate** |
| Silver group | Ag+,Pb+2,Hg2+2 | **dilute HCl** | **Agcl,Pbcl2,Hg2cl2** |
| Cupper and arsenic group | Hg+2,Cu+2,Cd+2,Pb+2,Bi+3 As+3,Sb+3,Sn+2 or +4 | H2S in presence of dilute HCl | HgS,CuS,CdS,PbS,Bi2S3 As2S3,Sb2S3,SnS2 |
| Iron group | Fe+3,Cr+3,Al+3 | **aqueous NH3 in** **presence of NH4Cl** | Fe(OH)3,Cr(OH)3,Al(OH)3 |
| Zinc group | Zn+2,Mn+2,Co+2,Ni+2 | **H2S in presence of aqueousNH3 and NH4Cl** | ZnS ,MnS ,CoS, NiS |
| Calcium group | Ca+2,Ba+2,Sr+2 | **(NH4)2CO3 in the** **presence of aqueousNH3 and NH4Cl** | CaCO3,BaCO3,SrCO3 |
| Alkali group | Mg+2,K+,Na+,NH4+ | **no particular reagent** | **Mg+2,K+,Na+,NH4+ in** **solution** |
|  | | | |

**(The Silver group) (groupI)**

**Silver, Lead, Mercury(ous)**

**Ag+, Pb+2, Hg2+2**

The compound of these metals are characterized by their precipitation as chloride by dilute (HCL) .Lead chloride PbCl2 is slightly soluble in water and hence is not completely precipitated as chloride in this group, it is therefore also found in group11,where it is precipitated as highly in soluble sulphide.

Note: We use dilute HCL as group reagent for precipitation and we do not use concentration HCL?

Because using conc. HCL will form a soluble chloro- complex.

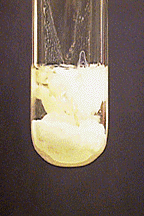
PbCl2 +2Cl- [PbCl4]-2

AgCl +Cl- [AgCl2]-

**Identification of Group 1**

Put 1ml of (Ag+1, Pb+2and Hg2+2) in a centrifuge tube

1N dilute HCL (5 drops), stir centrifuge (1-2) mint



**Residue****Filtrate**

AgCl,PbCl2,Hg2Cl2 may Contain Metal

White ppt. Ion of other groups

(REJECT)

1ml boiling D.W

Put the test tube in boiling water bath (2min)

And stir continuously, Centrifuge

**Residue** **Filtrate**

AgCl, Hg2Cl2 PbCl2

5drops

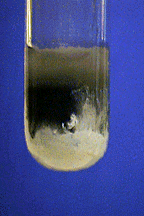
Dilute NH4OH(1N) 2drop CH3COONH4

Stir, Centrifuge 1drop K2CrO4



**Residue** **Filtrate****Yellow ppt.**

**Hg(black)+HgNH2Cl(s)** Ag(NH3)2Cl \_**(PbCrO4)**

**(white)**  it means that

2drop dilute Pb+2 is present

 HCl or HNO3

AgCl white ppt.

**Reactions:**

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AgNO3 + HCl AgCl + HNO3

Pb(NO3)2 + 2HCl PbCl2 +2HNO3

Hg2(NO3)2 + 2HCl Hg2Cl2 + 2HNO3

**Detection of Pb+2**

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Pb(NO3)2 + K2CrO4 **PbCrO4** + 2KNO3

**Yellow ppt.**

**Detection of Hg2+2**

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Hg2Cl2 + 2NH3 **HgNH2 Cl(s)** +**Hg(s)**+ NH4Cl(aq)

Mercury (II)amidochloride

**White ppt.** **Black**

**Detection of Ag+**

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AgCl +2NH3 Ag(NH3)2+Cl-

Ag(NH3)2+Cl- +2HNO3 AgCl +2NH4NO3

White ppt.