

# **Complimentary Chemistry**

**Code: 4CO5 CHE**

## **Practical notes for ANALYSIS OF CATIONS**

**BY**

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## ANALYSIS OF INORGANIC MIXTURE

### Test for Ammonium ion ( $\text{NH}_4^+$ )

1.	Little of the salt mixture solution is boiled with NaOH solution	A coloured gas with the smell of $\text{NH}_4^+$ which gave a dense white fumes when a glass rod dipped in conc.HCl is shown to it.	Presence of <i>Ammonium ion</i> is identified.
2.	Little of the salt mixture solution is boiled with NaOH solution and a piece of filter paper moisten with Nessler's reagent is shown to the gas	Paper turns brown	Presence of <i>Ammonium ion</i> is conformed.

## Inter group Separation of Cations

To a little of the salt solution is added to dil. HCl and filtered						
Residue.	Filtrate: H <sub>2</sub> S is passed through it					
Presence of gp.1 (Pb <sup>2+</sup> )	Residue. Presence of gp.II (Cu <sup>2+</sup> )	Filtrate: H <sub>2</sub> S is boiled off, NH <sub>4</sub> Cl salt and excess NH <sub>4</sub> OH are added.				
		Residue. Presence of gp.III (Al <sup>3+</sup> , Fe <sup>3+</sup> )	Filtrate: concentrated, excess NH <sub>4</sub> OH are added and H <sub>2</sub> S is passed.			
No residue Absence of gp. 1	No residue Absence of gp. II	Residue. Presence of gp.IV (Co <sup>2+</sup> , Ni <sup>2+</sup> , Zn <sup>2+</sup> , Mn <sup>2+</sup> )	Filtrate: H <sub>2</sub> S is boiled off, NH <sub>4</sub> Cl salt, NH <sub>4</sub> OH and (NH <sub>4</sub> ) <sub>2</sub> CO <sub>3</sub> are added.			
			Residue. Presence of gp.V (Ba <sup>2+</sup> , Ca <sup>2+</sup> , Sr <sup>2+</sup> )	Filtrate: NH <sub>4</sub> Cl salt, NH <sub>4</sub> OH and disodium hydrogen phosphate are added.		
		No residue Absence of gp. III	No residue Absence of gp. V		Residue. Presence of gp.VI (Mg <sup>2+</sup> )	
					No residue Absence of gp. VI	

## ANALYSIS OF GROUP RESIDUE

### Analysis of group 1 residue

The residue is boiled with about 10ml water and filtered while hot	
No residue. Absence of $\text{Ag}^+$ / $\text{Hg}^+$	Filtrate: Divide into two portions.  a. Acetic acid and potassium chromate solution are added to one part of the hot solution. ---- <i>Yellow precipitate</i> ---- <i>Presence of lead ion is identified.</i>  b. KI solution is added to the second part of the hot solution. ---- <i>Yellow precipitate soluble in hot water and reprecipitate as golden spangles on cooling.</i> ---- <i>Presence of lead is confirmed</i>

### Analysis of group II residue

The residue is boiled with a little NaOH solution and a few drops of yellow ammonium sulphide solution.	
Residue: Presence of gp: II A metal ions, PbS or CuS	
The II A precipitate is washed with hot water, then boiled with dil. $\text{HNO}_3$	
Filtrate: a. Add $\text{NH}_4\text{OH}$ solution drop-by-drop then excess. ---- <i>Blue solution</i> ---- <i>Presence of copper ion is identified.</i> b. The above blue solution is acidified with acetic acid and a drop potassium ferrocyanide solution . ---- <i>Reddish brown precipitate or colour.</i> ---- <i>Presence of copper ion is confirmed</i>	

### Analysis of group III residue

The residue is boiled with NaOH solution	
<p>Residue. (<math>Fe^{3+}</math>) The residue is dissolved in dil.HCl and heated and divided into two portions.</p> <p>a. To the one portion of the solution add potassium ferrocyanide solution. -----<i>Blue precipitate</i> ----<i>Presence of feric ion (<math>Fe^{3+}</math>) is identified.</i></p> <p>b. To the second portion of the solution add Ammonium thiocyanate solution. -----<i>Red blood colouration</i> ----<i>Presence of feric ion is confirmed</i></p>	<p><b>a. Filtrate</b> is acidified with dil.HCl(3 drops), then add <math>NH_4OH</math> in drops to the solution. -----<i>A white gelatinous precipitate.</i> ----<i>Presence of alumminium ion (<math>Al^{3+}</math>) is identified.</i></p> <p><b>b. Ash Test.</b> The residue is boiled with conc. <math>HNO_3</math> and a drop of cobalt nitrate solution. A piece of filter paper is moistening with this solution, then burn to ash. ----- <i>A blue tinted ash.</i> ----<i>Presence of alumminium ion (<math>Al^{3+}</math>) is confirmed.</i></p>

### Analysis of group VI residue

<p>a. To the residue add a few drops of mangenson reagent, and then excess NaOH solution. -----<i>Blue precipitate.</i> ----<i>Presence of magnesium ion (<math>Mg^{2+}</math>) is identified.</i></p> <p>b. <u>Ash Test</u> The residue is boiled with conc. <math>HNO_3</math> and a drop of cobalt nitrate solution. A piece of filter paper is moistening with this solution, then burn to ash. ----- <i>pink tinted ash.</i> ----<i>Presence of magnesium ion (<math>Mg^{2+}</math>) is confirmed.</i></p>
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## Analysis of group IV residue

The residue is washed with water, then add little dil.HCl and warmed.		
<p>Black precipitate: Presence of <math>\text{Ni}^{2+}</math> or <math>\text{Co}^{2+}</math></p> <p><u>Test for Nickel ion (<math>\text{Ni}^{2+}</math>)</u></p> <p>a. The precipitate is dissolved in aqua regia by heating in a china dish and the solution is evaporated nearly to dryness.</p> <p>--Yellow residue</p> <p>-- Presence of nickel ion is identified.</p> <p>b. To the precipitate add minimum quantity of water and excess of <math>\text{NH}_4\text{OH}</math> and dimethyl glyoxime.</p> <p>--Rose red precipitate</p> <p>--Presence of nickel ion is confirmed.</p> <p><u>Test for Cobalt (<math>\text{Co}^{2+}</math>)</u></p> <p>a. The precipitate is dissolved in aqua regia by heating in a china dish and the solution is evaporated nearly to dryness.</p> <p>--Blue residue</p> <p>-- Presence of cobalt ion is identified</p> <p>b. To the precipitate add minimum quantity of water and excess of <math>\text{NH}_4\text{OH}</math> and potassium ferricyanide soln.</p> <p>--Reddish brown precipitate</p> <p>--Presence of cobalt ion is confirmed.</p>	<p><b>Filtrate:</b> NaOH solution is added drop-by-drop and boiled.</p>	
	<p>--White precipitate turning brown.</p> <p>-- Presence of manganese ion (<math>\text{Mn}^{2+}</math>) is identified.</p> <p>b.<u>Permanganic acid test.</u></p> <p>A small quantity of the above precipitate is boiled with Conc. <math>\text{HNO}_3</math> and lead peroxide (<math>\text{PbO}_2</math>), diluted with water and kept for some time.</p> <p>---supernatent liquid is coloured purple.</p> <p>---- Presence of manganese ion is confirmed.</p>	<p><b>Filtrate:</b></p> <p>a. To the filtrates add acetic acid and potassium ferrocyanide solution.</p> <p>--White precipitate</p> <p>-- Presence of zinc ion (<math>\text{Zn}^{2+}</math>) is identified.</p> <p>b. <u>Ash Test</u></p> <p>The residue is boiled with conc. <math>\text{HNO}_3</math> and a drop of cobalt nitrate solution. A piece of filter paper is moistening with this solution, and then burn to ash.</p> <p>----- green tinted ash.</p> <p>----Presence of zinc ion is confirmed.</p>

## Analysis of group V residue

The residue is washed with water and dissolves in minimum quantity of acetic acid by boiling.

The solution is divided into three portions

a. To the first portion of the solution add potassium chromate solution.

*---Yellow precipitate  
---Presence of barium ion is identified*

**b. Flame test**

The residue is made a paste with Conc. HCl and a part of the paste is shown to the non-luminous flame.

*---Green colour is imparted to the flame.  
---Presence of barium ion is confirmed.*

a. To the second portion of the solution add excess  $\text{NH}_4\text{OH}$  and ammonium oxalate solution.

*---White crystalline precipitate.*

*--- Presence of calcium is identified*

**b. Flame test**

The residue is made a paste with Conc. HCl and a part of the paste is shown to the non-luminous flame.

*---Brick red colour is imparted to the flame.  
---Presence of calcium<sup>is</sup> confirmed.*

a. To the third portion of the solution adds two drops of calcium sulphate and boiled.

*---White precipitate.  
--- Presence of stronceium ion is identified*

or, (a) add potassium chromate solution

*---No yellow precipitate  
---Presence of stronceium ion is identified*

**b. Flame test**

The residue is made a paste with Conc. HCl and a part of the paste is shown to the non-luminous flame.

*---Crimson colour is imparted to the flame.  
---Presence of stronceium ion is confirmed.*