

GOVT. POLYTECHNIC, GAJAPATI

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AIM OF THE EXPERIMENT :-

To test the known basic radicals (ammonium, zinc, magnesium, aluminium, calcium, sodium and potassium) present in the given salt.

APPARATUS REQUIRED :-

1. Test tubes
2. Test tube holder
3. Blow pipe
4. Nichrome wire
5. Blue glass
6. Watch glass
7. Charcoal cavity.

CHEMICALS REQUIRED :-

1. Given salt
2. Various reagent
3. Litmus paper.

THEORY & PROCEDURE :-

A. DRY TEST FOR BASIC RADICALS :-

1. Heating in a dry test tube :-

Experiment	Observation	Inference
A small quantity of supplied salt was taken & heated in a clean, dry test tube first slowly and then strongly for about 3 to 4 minutes.	(a) Watere particles condensed at the cooler part of the test tube. (b) A sublimate was formed. White sublimate; NH_4NO_3 is volatile, but no white sublimate was produced. (c) The salt was decrepitate (cracking sound was produced) (d) Deflagration took place (catches fire) (e) Infusible mass left. (f) The salt changed colour: (i) Yellow when hot and white when cold (ii) Red to black when hot and	(a) The salt contains water of crystallization. (b) Volatile salt. May be NH_4^+ , Hg^{2+} or As^{3+} salts. (c) Crystalline salts. (d) Some nitrate or nitrite salts. (e) May be Mg^{2+} , Al^{3+} , Zn^{2+} etc. (f) (i) May be Zinc (Zn^{2+}) salt. (ii) May be Fe^{2+}

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brown when cold	ore Fe^{3+} .
(g) The salt was fused on heating and solidified on cooling.	(g) May be alkali or alkaline earth metal salts.
(h) The salt was swelled up on heating.	(h) May be Al^{3+} .
A gas or vapour was evolved.	
(i) A colourless, odourless gas (CO_2) which turned the lime water milky.	(i) May be the carbonate salts.
(ii) A colourless gas (NH_3) with pungent odour which turned the red litmus paper blue.	(ii) May be the ammonium salts.

II. Heating in a charcoal cavity :-

Experiment

Observation

Inference

A small cavity on a charcoal block was made. It was filled with the supplied salt. The salt was moistened with a drop of water.	(i) The salt decrepitated or cracking sound was produced. (ii) The salt volatilized completely with white fumes.	(i) Crystalline salts. (ii) May be ammonium, Arsenic or mercury salts (Soda lime and bulb tube test to be performed)
The salt was heated strongly with the oxidising flame for about three minutes with the help of a blow pipe.	(iii) The salt deflagrated. (iv) The salt may or may not melt but finally a white infusible incandescent residue (giving light) was left.	(iii) May be Nitrate or nitrite. (iv) Aluminium, Zinc, Magnesium, tin or alkaline earth metal salts (Cobalt nitrate test to be performed).
	(v) The salt melted and sinked	(v) May be alkali or

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into the charcoal cavity on heating and reappeared on cooling.

alkaline earth metal salts (flame test to be performed)

(vi) The salt was coloured and a coloured residue was left.

(vi) Maybe chromium, Manganese, Iron, Cobalt, nickel or copper salts. (Borax bead test to be performed)

III. Soda lime Test : (For volatile salts)

Experiment	Observation	Inference
A pinch of salt was taken in a watch glass. A little sodalime ($\text{NaOH} + \text{CaO}$) was added and few drops of water added to it. It was rubbed with the thumb.	(a) A colourless gas with smell of ammonia was evolved which produced a dense white fume with the concentrated HCl .	(a) NH_4^+ is present

IV. Cobalt Nitrate test: (For infusible salts)

Experiment	Observation	Inference
A small quantity of the salt was heated in a charcoal cavity in the oxidising flame with the help of a blow pipe till an infusible and incandescent residue was left. The residue was moistened in with a drop of Cobalt Nitrate solution and heated in the oxidising flame. The colour of the residue was noted.	(a) Blue (infusible) mass. (b) Green mass (c) Pink mass (d) Grey mass	(a) May be aluminium salt. (b) May be Zinc salt (c) May be Magnesium salt. (d) May be Calcium salt.

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V. Flame Test : (For fusible salts)

Experiment	Observation		Inference	
A nichrome wire was cleaned by rubbing it with sandpaper. It was dipped in concentrated HCl taken in a watch glass. It was shown to the non-luminous Bunsen flame till no colour to the Bunsen flame was imparted. The clean wire was moistened with concentrated HCl and it was touched with a little of the powdered salt. It was shown to the non-luminous flame. Then the colour of the flame was observed in naked eye and through double blue glass.	Colour of the flame			
	In naked eye		Through double blue glass	
	(i) Golden yellow	(i) Colourless	(i) May be Sodium salt	
	(ii) Violet	(ii) Crimson red	(ii) May be Potassium salt	
	(iii) Brick red	(iii) Light green	(iii) May be Calcium salt	
	(iv) Yellowish green	(iv) Bluish green	(iv) May be Barium salt.	

VI. Charcoal Cavity Reduction Test : (For white salts changing colour)

Experiment	Observation	Inference
An intimate mixture of salt, charcoal powder and fusion mixture was prepared in 1:3:1 proportion. A little of the mixture was taken in a charcoal cavity and was heated in the reducing flame with the help of a blow pipe	(i) White shining malleable bead with lemon yellow incrustation and the bead marks paper on	(i) May be Lead salt
	(ii) Red scale without incrustation.	(ii) May be Copper salt.

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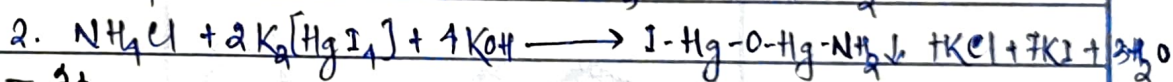
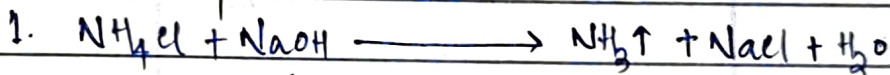
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B. WET TEST FOR BASIC RADICALS :-

Test for NH_4^+ :

Experiment	Observation	Inference
1. To about 1-2 ml of salt solution was treated with dil. NaOH and boiled.	1. Ammonia gas was evolved producing white fumes with a glass rod dipped in conc. HCl.	1. NH_4^+ is confirmed.
2. To 1-2 ml of the salt solution, about 1 ml of dil. NaOH solution was added followed with a little Nessler's reagent.	2. Brown ppt. was obtained.	2. NH_4^+ is confirmed. [This is due to formation of I-Hg-O-Hg-NH_2]

Explanation for NH_4^+ Test :-



Test for Zn^{2+} :-

Experiment	Observation	Inference
1. To about 1-2 ml of salt solution, solid NH_4Cl was added till saturation and dil. NH_4OH was added till ammoniacal and H_2S was passed through it.	1. A white precipitate was obtained.	1. May be Zn^{2+} . [It is due to the formation of ZnS]
2. To about 1-2 ml of salt solution, dil. NaOH solution was added drop by drop and then in excess.	2. A white ppt. was first obtained which was soluble in excess of the reagent.	2. Zn^{2+} is confirmed. [The white ppt. is due to the formation of $\text{Zn}(\text{OH})_2$ which gets dissolved with excess of the reagent due to the formation of Na_2ZnO_2]
3. To about 1-2 ml of salt solution, few drops of $\text{K}_4[\text{Fe}(\text{CN})_6]$ solution is added.	3. A white precipitate was obtained.	3. Zn^{2+} is confirmed. [This is due to the formation of Zinc ferrocyanide]

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Explanation for Zn^{2+} Test :

1. $ZnSO_4 + H_2S \longrightarrow ZnS \downarrow (\text{white}) + H_2SO_4$.
2. $ZnSO_4 + 2NaOH \longrightarrow Zn(OH)_2 \downarrow (\text{white}) + Na_2SO_4$.
3. $Zn(OH)_2 + 2NaOH \longrightarrow Na_2ZnO_2$ (Sodium Zincate) + $2H_2O$
4. $2ZnSO_4 + K_4[Fe(CN)_6] \longrightarrow Zn_2[Fe(CN)_6] + 2K_2SO_4$
Zinc ferrocyanide (white)

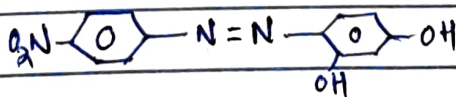
Test for Mg^{2+} :-

Experiment	Observation	Inference
1. To about 1-2 ml of salt solution, solid NH_4Cl was added till saturation and dil. NH_4OH was added till alkaline and disodium hydrogen phosphate solution was added to it.	1. A white precipitate was obtained.	1. May be Mg^{2+} . This is due to the formation of $Mg(NH_4)PO_4$
2. To about 1-2 ml of the salt solution about 1 ml of dil. HCl was added followed with 2-3 drops of Magneson reagent and the solution was made strongly alkaline with $NaOH$ solution.	2. A blue precipitate was obtained.	2. Mg^{2+} is confirmed. [This is due to the formation of Magnesium salt of Magneson reagent].

Explanation for Mg^{2+} Test :-

1. $MgSO_4 + Na_2HPO_4 + NH_4Cl \longrightarrow Mg(NH_4)PO_4 \downarrow (\text{white}) + Na_2SO_4 + HCl$.
2. Magnesium salt + Magneson Reagent \longrightarrow Blue ppt.
($C_{12}H_9N_3O_4$)

Magneson reagent is



4-(4-Nitrophenylazo)resorcinol.

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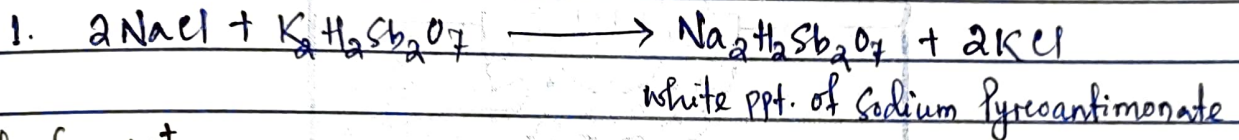
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Test for Na^+ :

Experiment	Observation	Inference
1. To about 1-2 ml of salt solution, about 1 ml of Potassium pyroantimonate solution was added and the inner side of the test tube was scratched with glass rod.	1. A white precipitate was obtained.	1. Na^+ is confirmed. [The ppt. is due to the formation of $\text{Na}_2\text{H}_2\text{Sb}_2\text{O}_7$]

Explanation for Na^+ Test :-



Test for K^+ :-

Experiment	Observation	Inference
1. To about 1-2 ml of salt solution, solid NaNO_2 was added till saturation followed with few drops of $\text{Co}(\text{NO}_2)_2$ solution. About 1 ml of dil. CH_3COOH was added to it and the solution was kept for sometime.	1. A yellow precipitate was obtained.	1. K^+ is confirmed. [This is due to the formation of $\text{K}_3[\text{Co}(\text{NO}_2)_6]$]

Explanation for K^+ Test :-

