EXPERIMENT-1

Aim: To identify Ca^{2+} cation in the given salt solution using NaOH & NH_4OH

Apparatus: Clean test tube, glass rod, dropper, test tube holder

OBSERVATION TABLE

TEST	OBSERVATION	INFERENCE
To the salt solution add NaOH solution	A white precipitate is obtained	Ca^{2+} or Pb^{2+} ion may be present
Add excess NaOH solution	White precipitate is insoluble	Ca^{2+} ion is formed
To the salt solution add NH_4OH solution	No precipitate is obtained	May be Ca^{2+} ion.
Add NH_4OH solution in excess	No precipitate is obtained	Ca^{2+} ion is formed

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EXPERIMENT-1

Aim:- To identify Ca^{2+} cation in the given salt solution using NaOH, NH_4OH solution

Apparatus:- Clean test tubes, glass rod, dropper, test tube holder

Chemicals:- NaOH solution, NH_4OH solution

Procedure:-

Take about 1-2 gram of salt solution for its cation identification. Add about 10mL of distilled water to the salt and shake well to obtain the aqueous solution.

Reactions:-

- With NaOH

$$Ca(NO_3)_2 + 2NaOH \longrightarrow \underset{\text{white ppt}}{Ca(OH)_2\downarrow} + 2NaNO_3$$

- With NH_4OH

$$Ca(NO_3)_2 + NH_4OH \longrightarrow \text{No precipitate}$$

Teacher's Signature ..... Mohinisha
11/2/22

EXPERIMENT-2

Aim: To identify Zn^{2+} ion in the given salt solution using NaOH and NH_4OH solution

Apparatus: Clean test tube, glass rod, dropper, test tube holder

OBSERVATION TABLE

TEST	OBSERVATION	INFERENCE
To the salt solution add NaOH solution	Geltanious white ppt is obtained	Zn^{2+} ion may be present
Add NaOH solution in excess	White ppt dissolves	Zn^{2+} ion is confirmed
To the given salt solution add NH_4OH solution	Geltanious white ppt is obtained	Zn^{2+} ion may be present
Add NH_4OH solution in excess	White ppt. dissolves	Zn^{2+} ion is confirmed

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EXPERIMENT - 2

Aim :- To identify Zn^{2+} cation in the given salt solution using NaOH & NH_4OH solutions

Apparatus :- Clean test tube, glass rod, dropper, test tube holder

Chemicals :- NaOH & NH_4OH solution.

Procedure :-

Take about 1-2 gram of salt solution for its cation identification. Add about 10mL of distilled water to the salt and well to obtain the aqueous salt solution

Reactions :-

- With NaOH

$$Zn(NO_3)_2 + 2NaOH \longrightarrow \underset{\text{white ppt}}{Zn(OH)_2\downarrow} + 2NaNO_3$$

$$Zn(OH)_2 + 2NaOH \rightarrow Na_2ZnO_2 + H_2O$$

- With NH_4OH

$$Zn(NO_3)_2 + 2NH_4OH \rightarrow \underset{\text{white ppt}}{Zn(OH)_2} + 2NH_4NO_3$$

$$Zn(OH)_2 + 4NH_4OH \rightarrow [Zn(NH_3)_4](OH)_2 + 4H_2O$$

Teacher's Signature ..... Mohinisha
11/2/22

EXPERIMENT-3

Aim: To identify Pb^{2+} ion in the given salt solution using NaOH and NH_4OH solution

Apparatus: Clean test tube, glass rod, dropper, test tube holder

OBSERVATION TABLE

TEST	OBSERVATION	INFERENCE
To the salt solution add NaOH solution	White ppt is obtained	Ca^{2+}, Zn^{2+} or Pb^{2+} may be present
Add NaOH solution in excess	white ppt dissolves	Zn^{2+} or Pb^{2+} may be present
To the salt solution add NH_4OH solution	White ppt is obtained	Zn^{2+} or Pb^{2+} may be present
Add NH_4OH solution in excess	White ppt doesn't dissolve [This is difference between Zn^{2+} & Pb^{2+} ions]	Pb^{2+} is confirmed

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EXPERIMENT-3

Aim:- To identify the cation Pb^{2+} in the given salt solution using NaOH & NH_4OH solution

Apparatus:- Clean test tube, test tube holder, glass rod, dropper

Chemicals:- NaOH & NH_4OH solution

Procedure:-

Take about 1-2 gm of the salt solution for its cation identification. Add about 10mL of distilled water to the salt & shake well to obtain the aqueous salt solution

Reactions:-

- With NaOH

$$Pb(NO_3)_2 + 2NaOH \rightarrow \underset{\text{white ppt}}{Pb(OH)_2} + 2NaNO_3$$

$$Pb(OH)_2 + 2NaOH \rightarrow Na_2PbO_2 + 2H_2O$$

- With NH_4OH

$$Pb(NO_3)_2 + 2NH_4OH \rightarrow \underset{\text{white ppt insoluble in excess}}{Pb(OH)_2} + 2NH_4NO_3$$

Teacher's Signature ..... Mohinisha

EXPERIMENT-4

Aim: To identify Cu^{2+} ions in the given salt solution using NaOH and NH_4OH solution.

Apparatus: Clean test tube, glass rod, dropper, test tube holder.

OBSERVATION TABLE

TEST	OBSERVATION	INFERENCE
To the salt sol. add NaOH sol.	Blue ppt is obtained	Cu^{2+} may be present
Add NaOH sol. in excess	ppt is insoluble	Cu^{2+} confirmed
To the salt sol. add NH_4OH sol.	Blue ppt is obtained	Cu^{2+} may be present
Add NH_4OH sol. in excess	Blue ppt dissolve giving oninky blue sol. of the complex salt	Cu^{2+} confirmed

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EXPERIMENT-4

Aim:- To identify Cu^{2+} cation in the given salt solution using NaOH & NH_4OH solution

Apparatus:- Clean test tube, test tube holder, glass rod, dropper

Chemicals:- NaOH solution & NH_4OH solution

Procedure:-

Take about 1-2 gm of salt solution for its cation identification. Add about 10 mL of distilled water to the salt & shake well to obtain the aqueous salt solution

Reactions:-

- With NaOH

$$CuSO_4 + 2\,NaOH \longrightarrow \underset{\text{Blue ppt}}{Cu(OH)_2\downarrow} + Na_2SO_4$$

- With NH_4OH

$$CuSO_4 + 2\,NH_4OH \rightarrow Cu(OH)_2\downarrow + (NH_4)_2SO_4$$

$$Cu(OH)_2 + 2\,NH_4OH + (NH_4)_2SO_4 \rightarrow [Cu(NH_3)_4]SO_4 + 4H_2O$$

Teacher's Signature ..... Mahimsha
11/2/22

EXPERIMENT-5

Aim: To identify Fe^{2+} ion in the given salt solution using NaOH and NH_4OH solution

Apparatus: Clean test tube, glass rod, dropper, test tube holder

OBSERVATION TABLE

TEST	OBSERVATION	INFERENCE
To the salt Sol. add NaOH sol.	Dirty green ppt is obtained	Fe^{2+} may be present
Add NaOH sol. in excess	ppt is insoluble	Fe^{2+} confirmed
To the salt Sol. add NH_4OH sol.	Dirty green ppt is obtained	Fe^{2+} may be present
Add NH_4OH sol. in excess	ppt is insoluble	Fe^{2+} confirmed

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EXPERIMENT-5

Aim:- To identify the cation Fe^{2+} present in a given salt solution using NaOH & NH_4OH solution

Apparatus:- Clean test tubes, glass rod, test tube holder, dropper

Chemicals:- NaOH solution & NH_4OH solution

Procedure:-

Take about 1-2 grams of salt solution for its cation identification. Add about 10mL of distilled water to the salt solution and shake well to obtain the aqueous salt solution

Reactions:-

- With NaOH

$$FeSO_4 + 2NaOH \rightarrow \underset{\text{dirty green ppt}}{Fe(OH)_2} + Na_2SO_4$$

- With NH_4OH

$$FeSO_4 + 2NH_4OH \rightarrow Fe(OH)_2 + (NH_4)_2SO_4$$

Teacher's Signature ..... Mohinisha
11/2/22

EXPERIMENT-6

Aim: To identify Fe^{3+} ions in the given salt solution using NaOH and NH_4OH solution

Apparatus: Clean test tube, glass rod, dropper, test tube holder

OBSERVATION TABLE

EXPERIMENT	OBSERVATION	INFERENCE
To the salt sol. add NaOH sol.	Reddish Brown ppt is obtained	Fe^{3+} may be present
Add NaOH sol. in excess	ppt is insoluble	Fe^{3+} confirmed
To the salt sol. add NH_4OH sol.	Reddish Brown ppt is obtained	Fe^{3+} may be present
Add NH_4OH sol. in excess	ppt is insoluble	Fe^{3+} confirmed

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EXPERIMENT-6

Aim :- To identify the cation Fe^{3+} in a given salt solution using NaOH & NH_4OH solution

Apparatus:- Clean test tube, glass rod, test tube holder, dropper

Chemicals :- NaOH solution & NH_4OH solution

Procedure :-

Take about 1-2 gm of the salt solution for its cation identification. Add about 10mL of distilled water to one salt and shake well to obtain the aqueous salt solution

Reactions :-

- With NaOH

$$FeCl_3 + 3NaOH \rightarrow \underset{\text{Reddish Brown ppt}}{Fe(OH)_3} + 3NaCl$$

- With NH_4OH

$$FeCl_3 + 3NH_4OH \rightarrow \underset{\text{Reddish Brown ppt}}{Fe(OH)_3} + 3NH_4Cl$$

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11/2/22

EXPERIMENT-7

Aim: To identify CO_3^{2-}, S^{2-}, SO_3^{2-} in the given salt solution using dilute H_2SO_4

Apparatus: Clean test tube, glass rod, test tube holder, spirit lamp

OBSERVATION TABLE

EXPERIMENT	OBSERVATION	INFERENCE
Given Salt + dil. H_2SO_4	Gas is evolved with effervescence	Gas may be SO_2 or CO_2
Bring moist blue litmus paper near gas	Blue litmus paper becomes red	CO_2 or SO_2 gas
Pass the gas through lime water	Lime water turns milky	CO_2 or SO_2 gas
Bring filter paper clipped in acidified KMO_4 or $K_2Cr_2O_7$ near the gas	No effect on filter paper	CO_2 gas confirmed. CO_3^{2-} ion in the salt confirmed

EXPERIMENT	OBSERVATION	INFERENCE
Given Salt + dilute H_2SO_4	Gas with suffocating smell of burning Sulphur is evolved	Gas may be SO_2

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EXPERIMENT-7

Aim :- To identify the anions CO_3^{2-}, S^{2-} & SO_3^{2-} in the given salt using dilute H_2SO_4

Apparatus :- Clean test tube, glass rod, test tube holder, spirit lamp

Procedure :-

Take about 1-2 gm of salt for anion identification. Add about 10mL of distilled water to the salt & shake well to obtain aqueous salt solution. The salt solutions are then acted upon by dilute H_2SO_4

Reactions :-

1. Carbonate ions -

$$Na_2CO_3 + H_2SO_4 (dil.) \longrightarrow Na_2SO_4 + H_2O + CO_2$$

$$CO_2 + \underset{\text{lime water}}{Ca(OH)_2} \longrightarrow \underset{\text{white}}{CaCO_3} + H_2O$$

2. Sulphite ions -

$$Na_2SO_3 + H_2SO_4 (dil.) \longrightarrow Na_2SO_4 + H_2O + SO_2$$

$$\underset{\text{orange}}{K_2Cr_2O_7} + H_2SO_4 + 3SO_2 \longrightarrow \underset{\text{green}}{Cr_2(SO_4)_3} + K_2SO_4 + H_2O$$

$$\underset{\text{Pink}}{2KMnO_4} + 2H_2O + 5SO_2 \longrightarrow \underset{\text{colourless}}{K_2SO_4 + 2MnSO_4} + 2H_2SO_4$$

Teacher's Signature .....

Bring fiter paper dipperd in acidified $K_2Cr_2O_7$ near the gas.	Orange coloured paper turns greer	Gas is SO_2. SO_3^{2-} is confirmed

EXPERIMENT	OBSERVATION	INFERENCE
Bring filter paper dipped in acidified $KMnO_4$ near the gas	Pink coloured paper turn colourless	SO_3^{2-} ion is confirmed
Given Salt + dil. H_2SO_4	A gas is evolved with smell of rotten eggs	H_2S gas may be present
Bring moist blue litmus paper near the gas	Blue litmus becomes Red	H_2S gas may be present
Bring lead acetate paper near the gas	Lead acetate paper turns black	Presence of S^{2-} ion is confirmed

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3. Sulphide ions -

$Na_2S + H_2SO_4$ (dil) $\longrightarrow Na_2SO_4 + H_2S\uparrow$

Rotten egg smell

$(CH_3COO)_2Pb + H_2S \longrightarrow PbS + CH_3COOH$

black

EXPERIMENT-8

Aim: To identify Cl^-, NO_3^- & SO_4^{2-} ion present in the salt using conc H_2SO_4

Apparatus:- Clean test tube, glass rod, spirit lamp, test tube holder

OBSERVATION TABLE

EXPERIMENT	OBSERVATION	INFERENCE
Given Sol. + dil. H_2SO_4	Colourless gas with pungent smell	Cl^- may be prepared
Wet Blue litmus paper	Becomes Red	Cl^- may be present
Glass rod dipped in NH_4OH bring it on the mouth of test tube	Dense white fumes of NH_4Cl are formed	Cl^- ion present
Add NH_4OH to above ppt	curdy white ppt dissolves	Cl^- ion confirmed

EXPERIMENT	OBSERVATION	INFERENCE
Given Salt + dil. H_2SO_4	Brown fumes with irritating odour	NO_2 gas may be present
Add Cu	Evolution of brown fumes intensified	NO_2 gas confirmed

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EXPERIMENT-8

Aim: To identify the anion Cl^-, NO_3^- and SO_4^{2-} present in the salt using conc. H_2SO_4

Apparatus: Clean test tube, glass rod, spirit lamp, test tube holder

Chemicals: MnO_2, conc. H_2SO_4, ammonia solution, $AgNO_3$, dil. HNO_3

Procedure:

Cl^- and NO_3^- are acted upon by conc. H_2SO_4.

Chemical Reactions involved in the reaction of :-

1. Chloride ions -

$$NaCl + H_2SO_4 \longrightarrow NaHSO_4 + HCl$$

$$HCl + NH_4 \longrightarrow NH_4Cl$$

(dense white fumes)

$$NaCl + AgNO_3 \longrightarrow AgCl + NaNO_3$$

(white ppt)

$$AgCl + NH_4OH \longrightarrow [Ag(NH_3)_2]Cl$$

2. Nitrate ions -

$$NaNO_3 + \text{conc. } H_2SO_4 \longrightarrow NaHSO_4 + HNO_3$$

$$Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$$

Ring test :-

$$2HNO_3 + FeSO_4 + H_2SO_4 \longrightarrow Fe(SO_4)_3 + H_2O + 2NO$$

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Given salt Sol. + freshly prepared $FeSO_4$ + conc. H_2SO_4 along the side of test tube	A brown ring is formed at the junction of two layer	Presence of NO_3^- confirmed

EXPERIMENT	OBSERVATION	INFERENCE
Given salt + $(CH_3COO)Pb$ Sol.	White ppt is formed	SO_4^{2-} may be present
To above ppt add CH_3COONH_4	White ppt dissolves	SO_4^{2-} gas may be present
Given salt sol. + $BaCl_2$	White ppt appear	SO_4^{2-} is confirmed
Add HCl to above	White ppt is insoluble	

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$FeSO_4 + NO \rightarrow [FeSO_4 \cdot NO]$

nitrous ferrous sulphate

EXPERIMENT-9

Aim: To study the effect of conc. HCl or metal oxide CuO

Apparatus: Clean test tube, glass rod, spirit lamp, test tube holder

OBSERVATION TABLE

EXPERIMENT	OBSERVATION	INFERENCE
Heat the substance & conc. HCl	Greenish yellow gas	This gas may be Cl_2
Pass the gas over red rose petal	Colour is bleached	The gas is bleached
Pass the gas over Starch iodide test tube	Dark blue colouration is produced	Cl_2 gas is confirmed
Solution of the substance + NH_4OH in excess	Blue ppt which dissolves in excess giving inky blue solution	Solution contains Cu^{2+} ion
Heat the ppt	Turns	Cu^{2+} confirmed

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EXPERIMENT-9

Aim: To study the effect of conc. HCl acid on metal oxide CuO

Apparatus: Clean test tube, glass rod, spirit lamp, test tube holder

Chemicals: CuO, conc. HCl, NH_4OH sol., NaOH sol., starch iodide paper

Procedure: Cupric oxide oxidises conc. HCl to evolve chlorine gas and itself is reduced to cuprous chloride when conc. HCl is added to CuO, Cl_2 gas is evolved and a green solution is formed in the test tube which turn blue on dilution.

$$2CuO + 4HCl \longrightarrow Cu_2Cl_2 + 2H_2O + Cl_2$$

$$Cu_2Cl_2 + Cl_2 + HCl \longrightarrow CuCl_4^{2-} + 4H^+$$

$$CuCl_4 + H^+ \xrightarrow{\text{dilution}} CuCl_2 + HCl$$

$$CuCl_2 + 2NH_4OH \longrightarrow Cu(OH)_2 + 2NH_4Cl$$

Teacher's Signature .....

11/2/22

EXPERIMENT-10

Aim: To study the effect of conc. HCl on metal oxide MnO_2

Apparatus: Clean test tube, glass rod, spirit lamp, test tube holder

OBSERVATION TABLE

EXPERIMENT	OBSERVATION	INFERENCE
Heat the substance & conc. HCl	Greenish yellow gas	Cl_2 may be present
Pass the gas over red rose plate	Colour is bleached	The gas is Cl_2
Pass the gas over Starch iodide paper	Dark blue colouration	Cl_2 gas is confirmed
Solution of substance + NaOH slowly in excess	ppt is formed which turns brown when exposed to air	Solution contains Mn^{2+} ion
Substance + Conc. HCl	Light pink solution is obtained	Mn^{2+} confirmed

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EXPERIMENT-10

Aim: To study the effect of conc. HCl on metal oxide MnO_2

Apparatus: Clean test tube, glass rod, spirit lamp, test tube holder

Chemicals: MnO_2, conc. HCl, NH_4OH, NaOH, starch iodide paper

Procedure: When conc. HCl is added to MnO_2 and mixture is heated. Cl_2 gas is evolved and light pink solution of $MnCl_2$ is formed in the test tube

$$MnO_2 + HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2(g)$$

(black powder) (light pink) (greenish yellow)

$$MnCl_2 + NaOH \longrightarrow Mn(OH)_2 + NaCl$$

$$2Mn(OH)_2 + O_2 \longrightarrow MnO(OH)_2$$

(Brown)

Teacher's Signature ..... Mohanishra

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EXPERIMENT-11

Aim: To determine the acidic & basic nature of solution

Apparatus: Clean test tube, test tube holder

OBSERVATION TABLE

EXPERIMENT	OBSERVATION		INFERENCE
Test with	Sol. A	Sol. B	
Blue litmus paper	No change in colour	Blue becomes Red	Sol. B is acidic
Red litmus paper	Red becomes Blue	No change in colour	Sol. A is Basic
Na_2CO_3 solution	No change	Effervescence with evolution of gas which turns lime water milky	Sol. B is acidic Gas is CO_2
Solid NH_4Cl	A colourless gas with pungent smell	A colourless gas with chocking smell	Sol A. is basic and gas is NH_3
	produces white fumes with conc. HCl	produces white ppt with $AgNO_3$ sol.	Sol. B is acidic and gas is HCl

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EXPERIMENT-11

Aim: To determine acidic and basic nature of solution

Apparatus: Clean test tube, test tube holder

Chemicals: Blue litmus paper, Red litmus paper, Na_2CO_3, NH_4Cl, $AgNO_3$, conc. HCl, lime water

Procedure: Solution A and B are acted upon by various reagent.

Chemical Reactions involved in the test:

$$H_2SO_4 + Na_2CO_3 \longrightarrow Na_2SO_4 + CO_2 + H_2O$$

(Sol. B)

$$NaOH + NH_4Cl \longrightarrow NaCl + NH_3 + H_2O$$

(Sol. A)

$$H_2SO_4 + NH_4Cl \longrightarrow (NH_4)_2SO_4 + 2HCl$$