Practical Work

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Solution 1:

(a) Chloride ion: A small amount of the salt is taken in a test tube and conc. H_2SO_4 is added to it and then test tube is warmed , if a colourless gas with pungent odour is evolved then chloride ions are present in the salt. It can be confirmed by bringing a glass rod dipped in ammonia solution near the gas evolved, if dense white fumes are formed then presence of chloride ions is confirmed.

(b) It is a greenish yellow coloured gas with sharp pungent smell. It turns moist blue litmus paper red and finally bleaches it.

(c) It is a colourless gas with a smell of burnt sulphur. It turns moist blue litmus paper red.

(d) A small quantity of salt is taken in a test tube, dilute sulphuric acid is added to it. If a brisk effervescence is observed, then the gas is passed through lime water, If carbonate ion is present in the salt, the solution turns milky.

(e) Zinc hydroxide is an amphoteric hydroxide. It can be identified by treating the salt solution with sodium hydroxide, if a white ppt. is formed and if it gets dissolved in excess of sodium hydroxide then it may be zinc hydroxide .

Solution 2:

(a) Copper carbonate

(b) Selenium

(c) Nitre –a nitrate of potassium

(d) Anhydrous calcium sulphate

Solution 3:

(a) NH_3: It has a strong pungent smell and turns moist red litmus blue. It can also be tested by bringing a glass rod dipped in conc. HCl in contact with the gas, if the gas is ammonia then it will produce dense white fumes near the glass rod.

(b) Oxygen: It is an odourless and colourless gas and turns alkaline pyrogallol brown. It can also be tested by bringing a lighted splinter near the gas, if the splinter starts glowing, the gas is oxygen.

(c) Water vapour: These are colourless vapours and are neutral to litmus. These can be tested by first condensing on the walls (cooler parts) of the test tube and then by adding anhydrous copper sulphate to the collected liquid , if the white colour of copper sulphate changes to blue, then the gas is water vapour.

Solution 4:

Flame test:

1. Make a loop at the tip of the platinum wire and dip it in conc. HCl.
2. Put it on the non luminous part of the flame, to see if it gives colour. Repeat the process till it gives no colour to the flame.
3. Prepare a paste of the given salt in a watch glass using conc. HCl.
4. Load the loop of the wire with this prepared paste and introduce it into the non luminous flame of the bunsen burner and then observe the colour of the flame indicating different elements.

Solution 5:

(a) When NH_3 solution is added to $CuSO_4$ solution drop by drop , ammonium ions completely react with copper sulphate and precipitates of copper hydroxide are formed

$$CuSO_4(aq) + 2NH_3(aq) + 2H_2O(l) \longrightarrow Cu(OH)_2(s) + (NH_4)_2SO_4(aq)$$

But when we add excess of ammonia, the precipitate dissolves and a soluble complex is formed .

$$CuSO_4(aq) + 4NH_3(aq) \longrightarrow [Cu(NH_3)_4]SO_4(aq)$$

(b) When Caustic soda solution is added to $Cu(NO_3)_2$ solution, the following reaction takes place :

$$Cu(NO_3)_2(aq) + 2\ NaOH(aq) \longrightarrow Cu(OH)_2(s) + 2\ NaNO_3(aq)$$

When we heat it further, the greenish blue copper hydroxide decomposes to form slightly black ppt. of copper oxide.

$$Cu(OH)_2(s) \xrightarrow{\Delta} CuO(s) + H_2O(g)$$

(c) Common salt solution is added to silver nitrate solution.

$$AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO_3(aq)$$

Common salt is NaCl, in aqueous medium it ionizes to form Na^+ and Cl^- ions.

$$NaCl(aq) \longrightarrow Na^+(aq) + Cl^-(aq)$$
$$Cl^-(aq) + Ag^+(aq) \longrightarrow AgCl(s)$$

On adding ammonia solution to it, the silver chloride gets dissolved and the following reaction occurs:

$$AgCl(s) + 2NH_3(aq) \rightarrow [Ag(NH_3)_2]^+(aq) + Cl^-(aq)$$

(d) When Lead nitrate solution is treated with calcium chloride solution it forms white ppt. of lead chloride and calcium nitrate

$$CaCl_2(s) \longrightarrow Ca^{2+}(aq) + Cl^-(aq)$$

$$Pb(NO_3)_2(aq) \longrightarrow Pb^{2+}(aq) + NO_3^{2-}(aq)$$
$$Pb^{2+}(aq) + NO_3^{2-}(aq) + Ca^{2+}(aq) + Cl^-(aq) \longrightarrow PbCl_2 + Ca(NO_3)_2$$

On further heating and cooling the products, calcium nitrate decomposes upon heating to release nitrogen dioxide:

$$2\ Ca(NO_3)_2 \rightarrow 2\ CaO + 4\ NO_2 + O_2$$

Solution 7:

Add concentrated hydrochloric acid to both the samples. Only MnO_2 releases greenish yellow chlorine gas.

Solution 8:

C is silver chloride which is soluble in ammonia.

Pungent smelling gas B is ammonia.

White solid A is ammonium chloride

$$\underset{A}{NH_4Cl(s)} \xrightarrow{NaOH} \underset{B}{NH_3(g)} + H2O + NaCl$$

$$NH_3(g) \xrightarrow{red\ litmus} blue\ litmus$$

$$\underset{A}{NH_4Cl(s)} \xrightarrow[HNO_3]{AgNO_3} \underset{C}{AgCl(s)}$$

Solution 9:

(a) Distilled water: same as that of universal indicator

(b) Acid rain: red

(c) Soap solution: purple

(d) soil containing slaked lime: green

(e) Gastric juices: orange

Solution 10:

(a) Ammonium sulphate on reacting with sodium hydroxide liberates ammonia gas:

$(NH_4)_2SO_4\,(aq) + 2NaOH\,(l) \rightarrow Na_2SO_4\,(aq) + 2NH_3\,(l) + 2H_2O\,(l)$

Sodium sulphate on reacting with sodium hydroxide undergoes the following change:

$NaOH + Na_2SO_4 \rightarrow NaOH + Na_2SO_4$

However the products would be the same as the reactants, therefore providing no observation for a visible chemical reaction.

(b) Sodium hydroxide reacts with zinc nitrate and zinc hydroxide is formed which is soluble in excess of sodium hydroxide

$$Zn(NO_3)_{2(aq)} + 2NaOH_{(aq)} \rightarrow Zn(OH)_{2(s)} + 2NaNO_{3(aq)}$$

Sodium hydroxide reacts with calcium nitrate and forms white ppt. of calcium hydroxide which is insoluble in excess of sodium hydroxide.

$$Ca(NO_3)_2 + 2NaOH \longrightarrow Ca(OH)_2 + 2NaNO_3$$

(c) Iron(III) chloride on reacting with sodium hydroxide forms brown ppt.

$$FeCl_{3(aq)} + 3NaOH_{(aq)} \rightarrow Fe(OH)_{3(s)} + 3NaCl_{(aq)}$$

brown

Iron (II) chloride on reacting with sodium hydroxide forms green ppt.

$$FeCl_{2(aq)} + 2NaOH_{(aq)} \rightarrow Fe(OH)_{2(s)} + 2NaCl_{(aq)}$$

green

Solution 1999-1:

(a) Sodium chloride solution and sodium nitrate solution can be distinguished by using conc. Sulphuric acid. To the salt solution, add freshly prepared ferrous sulphate solution and pour a few drops of conc. H_2SO_4 along the sides of the tube. If it's sodium nitrate solution then a brown ring would appear at the junction of the two liquid layers. But if its sodium chloride solution, it would not undergo any visible reaction.

(b) Sodium sulphate solution and sodium chloride solution can be distinguished by using barium chloride solution. Barium chloride solution on being added to sodium sulphate solution forms a white precipitate which is insoluble in conc. HCl. Whereas sodium chloride shows no reaction with barium chloride solution.

(c) Calcium nitrate solution and zinc nitrate solution can be distinguished by sodium hydroxide. Sodium hydroxide reacts with zinc nitrate and zinc hydroxide is formed which is soluble in excess of sodium hydroxide.

$$Zn(NO_3)_{2(aq)} + 2NaOH_{(aq)} \rightarrow Zn(OH)_{2(s)} + 2NaNO_{3(aq)}$$

Sodium hydroxide reacts with calcium nitrate and forms white ppt. of calcium hydroxide insoluble in excess of sodium hydroxide.

$$Ca(NO_3)_2 + 2NaOH \longrightarrow Ca(OH)_2 + 2NaNO_3$$

Solution 2000-1:

(i) Calcium nitrate:

a. with sodium hydroxide:

- $Ca(NO_3)_2 \xrightarrow{NaOH} Ca(OH)_2 + NaNO_3$
- White curdy ppt.is insoluble in excess of NaOH.

b. with ammonium hydroxide:

- $Ca(NO_3)_2 \xrightarrow{NH_4OH} Ca(OH)_2 + NH_4NO_3$
- No precipitation of $Ca(OH)_2$ even in excess of ammonium hydroxide.

(ii) zinc nitrate:

a. with sodium hydroxide:

- $Zn(NO_3) + 2NaOH \rightarrow Zn(OH)_2 + 2NaNO_3$
- On addition of excess of NaOH, white ppt. of $Zn(OH)_2$ dissolves.

b. with ammonium hydroxide:

- $Zn(NO_3) + 2NH_4OH \rightarrow Zn(OH)_2 + 2NH_4NO_3$
- The gelatinous white insoluble ppt. of $Zn(OH)_2$ dissolves in excess of ammonium hydroxide.

(iii) lead nitrate:

a. with sodium hydroxide:

- $Pb(NO)_3 + 2NaOH \longrightarrow Pb(OH)_2 + 2NaNO_3$
- White curdy ppt. is soluble in excess of NaOH.

b. with ammonium hydroxide:

- $Pb(NO)_3 + 2NH_4OH \longrightarrow Pb(OH)_2 + 2NH_4NO_3$
- White curdy ppt. is insoluble in excess of ammonium hydroxide.

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Solution 2001-1:

i. Answer: $Fe_2(SO_4)_3 + 6NH_4OH \rightarrow 2Fe(OH)_3\downarrow + 3(NH_4)_2SO_4$

reddish brown

Reddish brown ppt. of ferric hydroxide is formed which is insoluble in excess of ammonium hydroxide.

Solution 2001-2:

On heating $CuCO_3$, CuO is formed which is black in colour.

Solution 2002-1:

(i) Distinction between Zinc ion and Lead ion.

a. $ZnSO_4 + 2NH_4OH \rightarrow Zn(OH)_2\downarrow + (NH_4)_2SO_4$

$Zn(OH)_2$ forms white gelatinous precipitate. In the presence of excess of ammonium hydroxide these precipitates get dissolved.

b. $Pb(NO_3)_2 + 2NH_4OH \rightarrow Pb(OH)_2\downarrow + 2NH_4NO_3$

$Pb(OH)_2$ forms white precipitate. This precipitate is insoluble in the presence of excess of ammonium hydroxide.

Carbonate	Colour of residue on cooling
Zinc carbonate	1. white
Lead carbonate	2. red
Copper carbonate	3. black

Solution 2003-1:

i. When NaOH is added drop-wise to a solution of zinc sulphate, then the following reaction takes place:

$$ZnSO_4 + 2NaOH \rightarrow Zn(OH)_2\downarrow + Na_2SO_4$$

White gelatinous ppt.

When NaOH becomes in excess, then the following reaction takes place:

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

Colourless

ii. Dropwise addition of NH_4OH:

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

Blue ppt.

With excess of NH_4OH, the precipitate of copper(II) hydroxide dissolves as:

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

(In excess) Tetram mine copper (II) Sulphate

iii. Silver chloride is formed on adding hydrochloric acid in silver nitrate solution. On adding excess of ammonium chloride, white ppt. gets dissolved.

$$2\ AgCl\ (s) + 2\ NH_4OH\ (aq) \longrightarrow Ag_2O\ (s) + H_2O\ (l) + 2\ NH_4Cl\ (aq)$$

iv. Chlorine gas turns moist starch iodide paper black.

v. Purple colour of potassium permanganate gets discharged.

vi. Brick effervescence is observed and colourless and odourless CO_2 gas is evolved in both the cases.

Solution 2004-1:

Aqueous salt solution	**Colour of precipitate when NaOH is added in a small quantity**	**Nature of precipitate (soluble or insoluble) when NaOH is added in excess**
Copper (II) sulphate	(i) Pale blue	(vi) insoluble
Zinc nitrate	(ii) White	(vii) soluble
Lead nitrate	(iii) White	(viii) soluble
Calcium chloride	(iv) White curdy ppt.	(ix) insoluble
Iron (III) Sulphate	(iv) Reddish brown	(x) insoluble

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Solution 2004-2:

S. No.	Substance added	Gas evolved	Odour
1.	Calcium carbonate	CO_2	odourless
2.	Magnesium ribbon	H_2	odourless
3.	Manganese (IV) oxide with heating	Cl_2	pungent
4.	Sodium sulphide	H_2S	smell of rotten eggs

Solution 2005-1:

(i) Magnesium sulphate, Iron(II) sulphate

(ii) Zinc chloride, Iron(III) chloride

(iii) Lead nitrate

(iv) Copper nitrate

Solution 2006-1:

(a)

1. Calcium: white
2. Zinc: white
3. Lead: orangish red
4. Copper: black

(b)

1. Zinc nitrate and calcium nitrate solution can be distinguished by reaction with ammonium hydroxide. Zinc forms a white gelatinous ppt. whereas there is no precipitation of calcium hydroxide even with excess of ammonium hydroxide.

$$Zn(NO_3)_2 + 2NH_4OH \rightarrow Zn(OH)_2\downarrow + 2NH_4NO_3$$

White gelatinous ppt.

1. (a) Sodium chloride solution and sodium nitrate solution can be distinguished by using conc. Sulphuric acid. To the salt solution, add freshly prepared ferrous sulphate solution and pour a few drops of conc. H_2SO_4 along the sides of the tube. If it's sodium nitrate solution then a brown ring would appear at the junction of the two liquid layers. But if its sodium chloride solution, it would not undergo any visible reaction.

2. Iron (III) chloride solution and copper chloride solution can be distinguished by using ammonium hydroxide. Copper forms a blue ppt. of $Cu(OH)_2$ which is soluble in excess of ammonium hydroxide.

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

Whereas iron(III) forms a reddish brown ppt. of $Fe(OH)_3$ which is insoluble even in excess of ammonium hydroxide.

$$FeCl_3 + 3NH_4OH \rightarrow Fe(OH)_3 + 3NH_4Cl$$

Solution 2006-2:

Match the following:

Column A	Column B
1. A substance that turns moist starch iodide paper blue.	A. Ammonium sulphate
2. A compound which release a reddish brown gas on reaction with concentrate sulphuric acid and copper turnings.	B. Lead carbonate
3. A solution of this compound gives dirty green precipitate with sodium hydroxide.	C. Chlorine
4. A compound which on heating with sodium hydroxide produces a gas which forms dense white fumes with hydrogen chloride.	D. Copper nitrate
5. A white solid which gives a yellow residue on heating	E. Ferrous sulphate.

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Solution 2007-1:

Salt	Anion
A	Cl^-
B	S^{2-}
C	NO_3^-
D	SO_3^{2-}
E	CO_3^{2-}

Solution 2008-1:

Iron(II) sulphate