EXERCISE- 1 (A)

Question 1:

Write the probable colour of the following salts.
(a) Ferrous salts
(b) Ammonium salts
(c) Cupric salts
(d) Calcium salts
(e) Aluminium Salts

Solution 1:

(a) Ferrous salts : **Light green**
(b) Ammonium salts : **Colourless**
(c) Cupric salts : **Blue**
(d) Calcium salts : **Colourless**
(e) Aluminium salts : **Colourless**

Question 2:

Name:
(a) a metallic hydroxide soluble in excess of NH_4OH.
(b) a metallic oxide solube in excess of caustic soda solution.
(c) a strong alkali
(d) a weak alkali
(e) two coloured metal ions
(f) two coloured metal ions
(g) a metal that evolves a gas which burns with a pop sound when boiled with alkali solutions.
(h) two bases which are not alkalis but dissolves in alkalis to yield colourless solutions.
(j) a coloured cation not a representative element.

Solution 2:

(a) $Cu(OH)_2$
(b) ZnO
(c) NaOH
(d) NH_4OH
(e) Na^+, Ca^{2+}
(f) Fe^{2+}, Mn^{2+}
(g) Aluminium

(h) $Zn(OH)_2$ and $Al(OH)_3$
(i) PbO
(j) Ammonium ion

Question 3:

Write balanced equations for Q.2 (g) and (i)

Solution 3:

$2Al + 2NaOH + 2H_2O \longrightarrow 2NaAlO_2 + 3H_2$
(Hot and conc.) Sodium meta aluminate
(colourless)

$PbO + 2NaOH \longrightarrow Na_2PbO_2 + H_2O$
(Yellow) sodium plumbate
(colourless, soluble)

Question 4:

What happens when ammonia solution is added first dropwise and then in excess to the following solution:
(i) $CuSO_4$ (ii) $ZnSO_4$ (iii) $FeCI_3$
Write balanced equations for these reactions.

Solution 4:

(i)
$CuSO_4 + 2NH_4OH \longrightarrow Cu(OH)_2 \downarrow (NH_4)_2\ SO_4$
Blue pale blue ppt. colourless is solution
With excess of NH_4OH, ppt dissolves
$CU(OH)_2 + (NH_4)_2SO_4 + 2NH_4OH \longrightarrow [Cu(NH_3)_4]SO_4 + 4H_2O$
Excess Tetrammine
Copper(II) Sulphate

(ii)
$ZnSO_4 + 2NH_4OH \longrightarrow Zn(OH)_2 + (NH_4)_2\ SO_4$
Colourless white, gelatinous ppt colourless
With excess of NH_4OH, ppt dissolves
$Zn(OH)_2 + (NH_4)_2SO_4 + 2NH_4OH \longrightarrow [Zn(NH_3)_4]SO_4 + 4H_2O$
(excess) Tetramminezinc(II) Sulphate
(colourless)

(iii)
$FeCl_3 + 3NH_4OH \longrightarrow Fe(OH)_3 \downarrow + 3NH_4Cl$
Yellow solution reddish brown ppt. colourless in solution

Question 5:

What do you observe when caustic soda solution is added to the following solution, first a little and then in excess:
(a) $FeCl_3$
(b) $ZnSO_4$
(c) $Pb(NO_3)_2$
(d) $CuSO_4$
Write balanced equations for these reactions.

Solution 5:

(i) $FeCl_3 + 3NaOH \longrightarrow Fe(OH)_3 \downarrow 3\ NaCl$
Yellow reddish brown, ppt colourless in solution
In excess of alkali, the reddish brown ppt, of $Fe(OH)_3$ remains insoluble

(ii) $ZnSO_4 + 2NaOH \longrightarrow Zn(OH)_2 \downarrow + NaSO_4$
Colourless white gelatinous ppt. colourless
In excess of alkali, white gelatinous ppt. of $Zn(OH)_2$ becomes soluble
$Zn(OH)_2 + 2NaOH$ (Excess) $\longrightarrow Na_2ZnO2 + 2H_2O$
Sodium zincate (colourless)

(iii) $Pb(NO_3)_2 + 2NaOH \longrightarrow Pb(OH)_2 \downarrow + 2NaNO_3$
White ppt (colourless)

In excess of alkali, white precipitate of $Pb(OH)_2$ becom essoluble:
$Pb(OH)_2 + 2NaOH$(excess) $\longrightarrow Na_2PbO_2 + 2H_2O$
Sodium plumbate
{colourless}
$CuSO_4 + 2NaOH \longrightarrow Cu(OH)_2 \downarrow + 2NaSO_4$
Blue colourless pale blue ppt. { colourless}
In excess of alkali, pale blue precipitate of $Cu(OH)_2$ is insoluble

Question 6:

Name the chloride of a metal which is soluble in excess of ammonium hydroxide. Write equation for the same.

Solution 6:

Zinc chloride ($ZnCl_2$) is soluble in excess of ammonium hydroxide.

$ZnCI_2 + 2NH_4OH \longrightarrow Zn(OH)_2 \downarrow 2NH_4CI$

Colourless White gelatinous ppt.

With excess of NH_4oh ppt dissolves

$Zn(OH)_2 + 2NH_4CI + 2NH_4OH$ (excess) $\longrightarrow [Zn(NH_3)_4]CI_2 + 4H_2O$

Tetram mine zinc (II) Chloride

Colourless

Question 7:

On adding dilute ammonia solution to a colourless solution of a salt, a white gelatinous precipitate appears. This precipitate however dissolves on addition of excess of ammonia solution identify (choose from Na, Al, Zn, Pb, Fe)

(a) Which metal salt solution was used?

(b) what is the formula of the white gelatinous precipitate obtained?

Solution 7:

(a) $ZnCl_2$

(b) $Zn(OH)_2$

Question 8:

Name:

(a) a yellow monoxide that dissolves in hot and concentrated caustic alkali

(b) a white, insoluble oxide that dissolves when fused with caustic soda or caustic potash

(c) a compound containing zinc in the anion

Solution 8:

(a) PbO

(b) ZnO

(c) K_2ZnO_2

Question 9:

What do you observe when freshly precipitated aluminium hydroxide reacts with caustic soda solution? Give balanced equation.

Solution 9:

(a) (iii)

Aqueous solution of copper sulphate is blue.

(b) (iii)

$FeSO_4 + 2NaOH \rightarrow Fe(OH)_2 + Na_2SO_4$

(Dirty green, (Colourless)

gelatinous ppt.)

(c) (iii)

$Zn + 2NaOH \rightarrow Na_2ZnO_2 + H_2$

Sodium zincate

(Colourless)

Zz $Zn + HCl \rightarrow ZnCl_2 + H_2$

Question 10:

What do you understand by amphoteric oxide Give the balanced equations for the reaction with three different amphoteric oxides with a caustic alkali. Write you observation if any.

Solution 10:

When freshly precipitated aluminum hydroxide reacts with caustic soda solution, whitesalt of sodium meta aluminate is obtained.

$Al(OH)_3 + NaOH \rightarrow NaAlO_2 + 2H_2O$

Sodium meta aluminate

Question 11:

Distinguish by adding:

(a) sodium hydroxide solution and

(b) Ammonium hydroxide solution to

(i) Calcium salt solution and lead salt solution

(ii) Lead salt solution and ferrous salt solution

(iii) copper salt solution and ferrous salt solution

(iv) Fe (II) salt solution and Fe (III) Salt solution

(v) Ferrous nitrate and lead nitrate

Solution 11:

(a) Distinguish by adding Sodium hydroxide solution:

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

On adding excess of NaOH, ppt. of Ca $(OH)_2$ is sparingly soluble.

$Pb(NO_3)_2 + 2NaOH \rightarrow Pb(OH)_2 + 2NaNO_3$

On adding excess of NaOH, ppt of $Pb(OH)_2$ is soluble.

(ii) $Pb(NO_3)_2 + 2NaOH \rightarrow Pb(OH)_2 + 2NaNO_3$

On adding excess of NaOH, ppt of $Pb(OH)_2$is soluble.

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

With excess of NaOH, white gelatinous ppt. of Zn $(OH)_2$ is soluble. So, these two cannot be distinguished by NaOH alone. However white ppt. of Pb $(OH)_2$is readily soluble in acetic acid also.

(iii) $CuSO_4 + 2NaOH \rightarrow Cu(OH)_2 + Na_2SO_4$

With excess of NaOH, alkali pale blue ppt of Cu $(OH)_2$ is insoluble.

$FeSO_4 + 2NaOH \rightarrow Fe(OH)_2 + Na_2SO_4$

With excess of NaOH, dirty green ppt. of $Fe(OH)_2$ is insoluble.

(iv) $FeSO_4 + 2NaOH \rightarrow Fe(OH)_2 + NaSO_4$

With excess of NaOH, dirty green ppt of Fe $(OH)_2$ is insoluble.

$FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$

With excess of NaOH, reddish brown ppt of Fe $(OH)_3$ is insoluble.

(b) Distinguish by adding Ammonium hydroxide solution:

(i) On addition of NH_4OH to calcium salts no precipitation of Ca $(OH)_2$ occurs even with addition of excess of NH_4OH because the concentration of OH^- ions from ionization of NH_4OH is so low that it cannot precipitate the hydroxide of calcium.

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

On adding excess of NH_4OH, chalky white ppt. of Pb $(OH)_2$ is insoluble.

(ii) $Pb(NO_3)_2 + 2\ NH_4OH \rightarrow Pb(OH)_2 + 2NH_4NO_3$

On adding excess of NH_4OH, chalky white ppt. of $Pb(OH)_2$ is insoluble.

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

With excess of NH_4OH, white gelatinous ppt. of Zn $(OH)_2$ is soluble.

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

With excess of NH_4OH, pale blue ppt. of Cu $(OH)_2$ is soluble.

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

With excess of NH_4OH, dirty green ppt. of Fe $(OH)_2$ is insoluble.

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

With excess of NH_4OH, dirty green ppt. of Fe $(OH)_2$ is insoluble.

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

With excess of NH_4OH, reddish brown ppt of Fe $(OH)_3$ is insoluble.

Question 12:

You are provided with two reagent bottles marked A and B. One of which contains NH_4OH solution and the other contains NaOH solution. How will you identify them by a chemical test?

Solution 12:

Reagent bottles A and B can identified by using calcium salts such as $Ca(NO_3)_2$.

On adding NaOH to Ca $(NO_3)_2$, Ca $(OH)_2$ is precipitated as white precipitate which is sparingly soluble in excess of NaOH.

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

Whereas, on addition of NH_4OH to calcium salts, no precipitation of $Ca(OH)_2$ occurs even with addition of excess of NH_4OH because the concentration of OH^- ions from the ionization of NH_4OH is so low that it cannot precipitate the hydroxide of calcium.

So the reagent bottle which gives white precipitate is NaOH and the other is NH_4OH.

INTEXT QUESTIONS:

Question 1:

What do you understand by the following:

(i) Analysis

(ii) Qualitative analysis

(iii) Reagent

(iv) Precipitation

Solution 1:

(i) **Analysis:** The determination of chemical components in a given sample is called analysis.

(ii) **Qualitative analysis:** The analysis which involves the identification of the unknown substances in a given sample is called qualitative analysis.

(iii) **Reagent:** A reagent is a substance that reacts with another substance.

(iv) **Precipitation:** It is the process of formation of an insoluble solid when solutions are mixed. The solid thus formed is called precipitate.

Question 2:

Write the probable colour of the following salts:

(i) Iron (III) chloride

(ii) Potassium nitrate

(iii) Ferrous sulphate
(iv) Aluminium acetate
(v) Calcium carbonate

Solution 2:

(i) Yellow
(ii) Colourless
(iii) PaleGreen
(iv) Colourless
(v) Colourless

Question 3:

Name the probable cation present in each of the following solution:
(i) Yellow coloured solution
(ii) blue coloured solution
(iii) Light blue coloured solution
(iv) Pink coloured solution

Solution 3:

(i) Fe^{3+}
(ii) Cu^{2+}
(iii) Cu^{+2}
(iv) Mn^{2+}

Question 4:

Name the metal hydroxides which are:
(i) Sparingly soluble
(ii) Insoluble
(iii) Soluble
In caustic soda solution

Solution 4:

(i) $Ca(OH)_2$
(ii) $Fe(OH)_2$ and $Cu(OH)_2$
(iii) $Zn(OH)_2$ and $Pb(OH)_2$

Question 5:

What do you observe when ammonium salt is heated with caustic soda solution? Write the balanced equation.

Solution 5:

When ammonium salt is heated with caustic soda solution, ammonia gas is evolved.

The balance equation is:

$NH_4Cl + NaOH \xrightarrow{\Delta} NaCl + H_2O + NH_3$

$(NH_4)_2SO_4 + 2NaOH \xrightarrow{\Delta} Na_2SO_4 + 2H_2O + 2NH_3$

Question 6:

How will you distinguish NH_4OH solution from NaOH solution?

Solution 6:

NH_4OH and NaOH can be distinguished by using calcium salts.

For example on adding NaOH to $Ca(NO_3)_2$, $Ca(OH)_2$ is obtained as white precipitate which is sparingly soluble in excess of NaOH.

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

On addition of NH_4OH to calcium salts, no precipitation of $Ca(OH)_2$ occurs even with the addition of excess of NH_4OH. This is because the concentration of OH^- ions from the ionization of NH_4OH is so low that it cannot precipitate the hydroxide of calcium.

Question 7:

Name the metal hydroxides which are:

(i) Insoluble (ii) Soluble.

In ammonium hydroxide solution

Solution 7:

(i) $Fe(OH)_2$ and $Pb(OH)_2$

(ii) $Cu(OH)_2$ and $Zn(OH)_2$