

**CLASS 10<sup>TH</sup> CHEMISTRY WORKSHEET CHAPTER – ANALYTICAL CHEMISTRY**

**Intext Questions 1**

**Question 1**

What do you understand by the following:

- (a) Analysis
- (b) Qualitative analysis
- (c) Reagent
- (d) Precipitation

**Answer**

- (a) Analysis — Determination of the chemical components in a given sample is called **Analysis**.
- (b) Qualitative analysis — Identification of the unknown substances in a given sample is called **Qualitative analysis**.
- (c) Reagent — A **reagent** is a substance that reacts with another substances.
- (d) Precipitation — The process of formation of an insoluble solid when solutions are mixed is called Precipitation. The solid thus formed is called **Precipitate**.

**Question 2**

Write the probable colour of the following salts:

- (a) Iron (III) chloride
- (b) Potassium nitrate
- (c) Ferrous sulphate
- (d) Aluminium acetate

**Answer**

- (a) Iron (III) chloride — Yellow
- (b) Potassium nitrate — Colourless
- (c) Ferrous sulphate — Pale Green
- (d) Aluminium acetate — Colourless

**Question 3**

Name the probable cation present based on the following observations:

- (a) White precipitate insoluble in  $\text{NH}_4\text{OH}$  but soluble in  $\text{NaOH}$ .
- (b) Blue coloured solution.

**Answer**

- (a)  $\text{Pb}^{2+}$
- (b)  $\text{Cu}^{2+}$

**Question 4**

Name the metal hydroxides which are:

- (a) Insoluble
  - (b) Soluble
- in
- (i) caustic soda solution
  - (ii) Ammonium hydroxide solution

**Answer**

Name of the solution	Soluble metal hydroxide	Insoluble metal hydroxide
Caustic soda solution	$\text{Zn}(\text{OH})_2$ , $\text{Pb}(\text{OH})_2$	$\text{Fe}(\text{OH})_2$ , $\text{Fe}(\text{OH})_3$ , $\text{Cu}(\text{OH})_2$
Ammonium hydroxide solution	$\text{Zn}(\text{OH})_2$ , $\text{Cu}(\text{OH})_2$	$\text{Fe}(\text{OH})_2$ , $\text{Fe}(\text{OH})_3$ , $\text{Pb}(\text{OH})_2$

**Question 5**

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

**Answer**

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

The word equation is:

Ammonium Salt + Sodium

Hydroxide

Δ

→

Sodium Salt + Water + Ammonia Gas

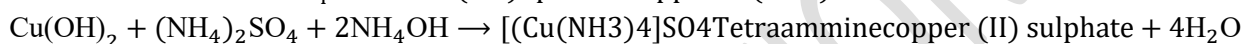
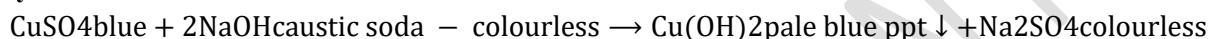
**Question 6**

How will you distinguish  $\text{NH}_4\text{OH}$  solution from  $\text{NaOH}$  solution?

**Answer**

$\text{NH}_4\text{OH}$  and  $\text{NaOH}$  can be distinguished by using  $\text{CuSO}_4$ .

$\text{CuSO}_4$  forms a **pale blue precipitate which is insoluble in excess of sodium hydroxide** and with ammonium hydroxide it forms a **pale blue precipitate which dissolves in excess of ammonium hydroxide and forms a deep/inky blue solution**.



**Question 7**

Why the alkali is added drop by drop to the salt solution?

**Answer**

If an alkali is added too quickly, then it is easy to miss a precipitate that redissolves in excess alkali.

**Question 8**

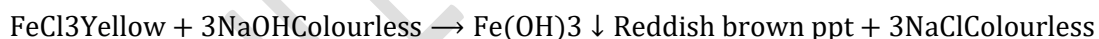
Write balanced equation:

(a) Reaction of sodium hydroxide solution with Iron (III) chloride solution

(b) Copper sulphate solution with ammonium hydroxide solution

**Answer**

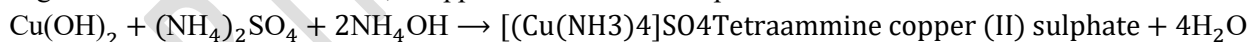
(a) When sodium hydroxide solution is added to  $\text{FeCl}_3$  dropwise, a reddish brown ppt is obtained, which is insoluble in excess of  $\text{NaOH}$ :



(b) When ammonia solution is added dropwise to copper sulphate, a pale blue ppt of copper hydroxide is obtained.



On adding excess of ammonia solution, the ppt dissolves and a deep blue solution is obtained.



**Exercise 4 — Multiple Choice Type**

**Question 1**

The colour of an aqueous solution of copper sulphate is:

1. Green
2. Brown
3. Blue
4. Yellow

**Answer**

Blue

**Reason** — Aqueous solution of copper sulphate is blue.

**Question 2**

The colour of the precipitate formed on adding  $\text{NaOH}$  solution to iron (II) sulphate solution is:

1. White
2. Brown

3. Green
4. Pale blue

**Answer**

Green

**Reason** — Dirty green precipitate of Ferrous Hydroxide  $[\text{Fe}(\text{OH})_2]$  is formed.

**Question 3**

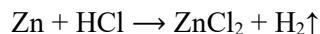
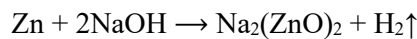
A metal which produces hydrogen on reacting with alkali as well as with acid:

1. Iron
2. Magnesium
3. Zinc
4. Copper

**Answer**

Zinc

**Reason** — Reactions of Zinc with alkali and acid are shown below:



**Question 4**

The salt solution which does not react with ammonium hydroxide is:

1. Calcium nitrate
2. Zinc nitrate
3. Lead nitrate
4. Copper nitrate

**Answer**

Calcium Nitrate

**Reason** — No ppt. occurs even with addition of excess of ammonium hydroxide as the concentration of  $\text{OH}^-$  ions from the ionization of  $\text{NH}_4\text{OH}$  is so low that it cannot precipitate the hydroxide of calcium.

**Question 5**

Which of the following is the best reagent to distinguish lead nitrate and zinc nitrate ?

**P** NaOH solution

**Q** KOH solution

**R**  $\text{NH}_4\text{OH}$  solution

1. Only P
2. Only R
3. Only Q
4. Both P and Q

**Answer**

Both P and Q

**Reason** — On adding NaOH or KOH to lead nitrate, a white precipitate of lead hydroxide  $[\text{Pb}(\text{OH})_2]$  is formed, which is **insoluble** in excess NaOH or KOH.

On adding NaOH or KOH to zinc nitrate, a white precipitate of zinc hydroxide  $[\text{Zn}(\text{OH})_2]$  is formed, which is **soluble** in excess NaOH or KOH, forming a clear solution.

Even though  $\text{NH}_4\text{OH}$  can separate the two, it is not the most effective reagent because, although it produces a white precipitate with both, lead hydroxide does not dissolve in excess  $\text{NH}_4\text{OH}$ , while zinc hydroxide does.

**Question 6**

**Assertion (A):** Calcium salt solution does not show any change even after adding an excess of ammonia solution to it.

**Reason (R):** The low concentration of hydroxide ion in ammonium hydroxide solution which are unable to precipitate the hydroxide ions of calcium

1. Both A and R are true and R is the correct explanation of A.

2. Both A and R are true but R is not the correct explanation of A.
3. A is true but R is false.
4. A is false but R is true.

**Answer**

Both A and R are true and R is the correct explanation of A.

**Explanation** — Calcium salt will not show precipitation even with addition of excess of  $\text{NH}_4\text{OH}$ . This is because the concentration of  $\text{OH}^-$  ions from the ionization of  $\text{NH}_4\text{OH}$  is so low that it cannot precipitate the hydroxide of calcium. Hence both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

**Question 7**

**Assertion (A):** Iron (II) salt solution when reacted with ammonium hydroxide forms a dirty green precipitate.

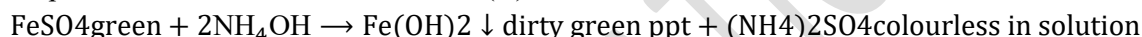
**Reason (R):** Iron salts are brown in colour.

1. Both A and R are true and R is the correct explanation of A.
2. Both A and R are true but R is not the correct explanation of A.
3. A is true but R is false.
4. A is false but R is true.

**Answer**

A is true but R is false.

**Explanation** — When Iron (II) salt (Green colour) solution are reacted with ammonium hydroxide, a dirty green insoluble precipitate is formed. Hence the assertion (A) is true.



Iron (II) salts are Green and Iron (III) salts are yellow in colour so reason (R) is false.

**Question 8**

**Assertion (A):** Hydrogen gas is liberated when metals like Zn, Al, Pb react with caustic alkalies.

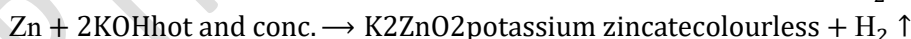
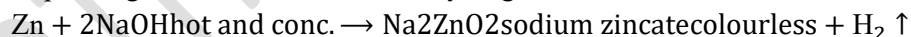
**Reason (R):** Alkalies are soluble in water.

1. Both A and R are true and R is the correct explanation of A.
2. Both A and R are true but R is not the correct explanation of A.
3. A is true but R is false.
4. A is false but R is true.

**Answer**

Both A and R are true but R is not the correct explanation of A.

**Explanation** — Certain metals like zinc, aluminium and lead react with hot concentrated caustic alkalis ( $\text{NaOH}$ ,  $\text{KOH}$ ) to give the corresponding soluble salt and liberate hydrogen.



Hence the assertion (A) is true.

Alkalies are bases that are soluble in water. When dissolved in water, alkalis release hydroxide ions ( $\text{OH}^-$ ), making the solution basic ( $\text{pH} > 7$ ). Hence reason (R) is true but it does not support assertion (A).

**Question 9**

**Assertion (A):** Oxides of most of the metals are basic in nature.

**Reason (R):** All metal oxides dissolve in water forming alkalis.

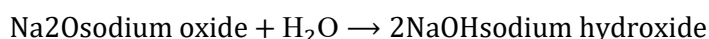
1. Both A and R are true and R is the correct explanation of A.
2. Both A and R are true but R is not the correct explanation of A.
3. A is true but R is false.
4. A is false but R is true.

**Answer**

A is true but R is false.

**Explanation** — Oxides of most of the metals are basic in nature. They dissolve in water forming hydroxides (or alkalis).

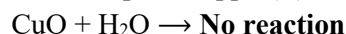
For example:



Hence the assertion (A) is true.

Reason (R) is false because, not all metal oxides dissolve in water to form alkalis. A few metallic oxides and hydroxides exhibit dual character, i.e., they show acidic as well as basic character. They are said to be amphoteric in nature.

For example : Copper(II) oxide (CuO)



### Question 10

**Assertion (A):** Zinc oxide reacts with acids as well as bases to form salt and water.

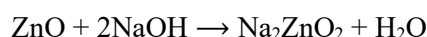
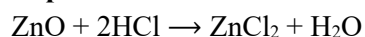
**Reason (R):** Zinc oxide is amphoteric in nature.

1. Both A and R are true and R is the correct explanation of A.
2. Both A and R are true but R is not the correct explanation of A.
3. A is true but R is false.
4. A is false but R is true.

### Answer

Both A and R are true and R is the correct explanation of A.

**Explanation** — Zinc oxide reacts with both acids and concentrated alkalis (NaOH and KOH) forming salt and water.



Hence the assertion (a) is true.

Reason (R) is true because zinc oxide is amphoteric in nature, reacts with both acids and concentrated alkalis forming salt and water. Hence Both A and R are true and reason (R) is the correct explanation of assertion(A).

### Exercise 4 — Very Short Answer Type

#### Question 1

Name:

- (a) two coloured metal ions.
- (b) a metal that evolves a gas which burns with a pop sound when boiled with alkali solutions.
- (c) two bases which are not alkalis but dissolve in strong alkalis.
- (d) a coloured metallic oxide which dissolves in alkalis to yield colourless solutions.
- (e) a colourless cation not a representative element.
- (f) a yellow monoxide that dissolves in hot and concentrated caustic alkali.
- (g) a white, insoluble oxide that dissolves when fused with caustic soda or caustic potash.
- (h) a compound containing zinc in the anion.

### Answer

- (a) Cupric ion  $[\text{Cu}^{2+}]$ , Ferrous ion  $[\text{Fe}^{2+}]$
- (b) Aluminium  $[\text{Al}]$
- (c) Zinc hydroxide  $[\text{Zn}(\text{OH})_2]$  and Lead hydroxide  $[\text{Pb}(\text{OH})_2]$
- (d) Lead oxide  $[\text{PbO}]$
- (e) Ammonium ion  $[\text{NH}_4^+]$
- (f) Lead oxide  $[\text{PbO}]$
- (g) Zinc oxide  $[\text{ZnO}]$
- (h) Potassium Zincate  $[\text{K}_2\text{ZnO}_2]$

#### Question 2

Write the probable colour of the following salts?

- (a) Ferrous salts
- (b) Ammonium salts
- (c) Cupric salts

- (d) Calcium salts  
(e) Aluminium salts

**Answer**

- (a) Ferrous salts — Pale Green  
(b) Ammonium salts — Colourless  
(c) Cupric salts — Blue  
(d) Calcium salts — Colourless  
(e) Aluminium salts — Colourless

**Exercise 4 — Short Answer Type**

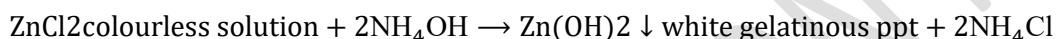
**Question 1**

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

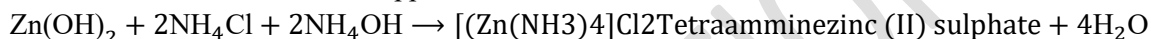
**Answer**

Zinc chloride ( $\text{ZnCl}_2$ ) is soluble in excess of ammonium hydroxide.

When ammonia solution is added dropwise to zinc chloride solution, a white gelatinous ppt of zinc hydroxide is obtained.



On adding excess of ammonia solution, the ppt dissolves and a colourless solution is obtained.



**Question 2**

What happens when ammonia solution is added first dropwise and then in excess to the following solutions:

- (i)  $\text{CuSO}_4$   
(ii)  $\text{ZnSO}_4$   
(iii)  $\text{FeCl}_3$

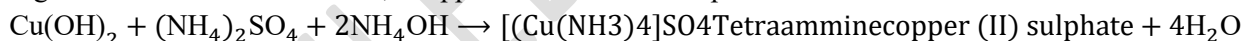
Write balanced equations for these reactions.

**Answer**

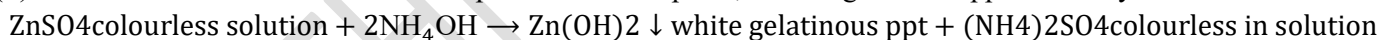
- (i) When ammonia solution is added dropwise to copper sulphate, a pale blue ppt of copper hydroxide is obtained.



On adding excess of ammonia solution, the ppt dissolves and a deep blue solution is obtained.



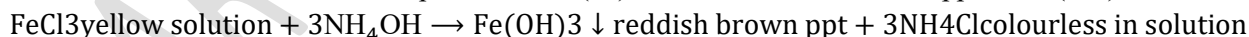
- (ii) When ammonia solution is added dropwise to zinc sulphate, a white gelatinous ppt of zinc hydroxide is obtained.



On adding excess of ammonia solution, the ppt dissolves and a colourless solution is obtained.



- (iii) When ammonia solution is added dropwise to iron (III) chloride, a reddish brown ppt. of  $\text{Fe(OH)}_3$  is obtained.



Excess of ammonia solution addition doesn't dissolve ppt.

**Question 3**

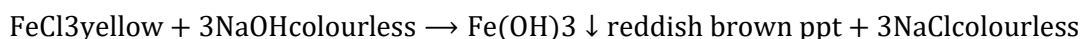
What do you observe when caustic soda solution is added to the following solution, first a little and then in excess :

- (a)  $\text{FeCl}_3$   
(b)  $\text{ZnSO}_4$   
(c)  $\text{Pb(NO}_3)_2$   
(d)  $\text{CuSO}_4$

Write balanced equations for these reactions.

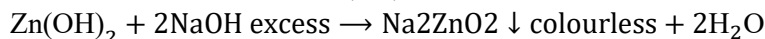
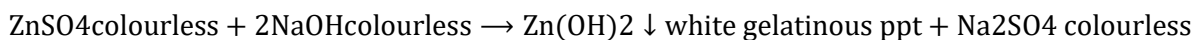
**Answer**

- (a) When caustic soda solution is added to  $\text{FeCl}_3$  dropwise, a reddish brown ppt is obtained, which is insoluble in excess of  $\text{NaOH}$ :

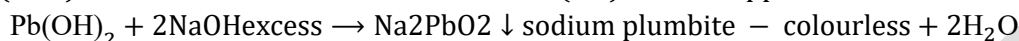
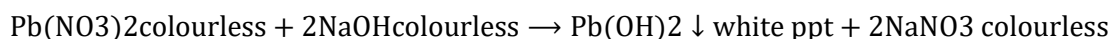




(b) When caustic soda solution is added to Zinc sulphate dropwise, a white gelatinous ppt is obtained, which dissolves in excess of NaOH:



(c) When caustic soda solution is added to  $\text{Pb(NO}_3)_2$  dropwise, a chalky white ppt is obtained, which dissolves in excess of NaOH:



(d) When caustic soda solution is added to  $\text{CuSO}_4$  dropwise, a pale blue ppt is obtained, which is insoluble in excess of NaOH:



#### Question 4

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

**Answer**

When freshly precipitated aluminum hydroxide reacts with caustic soda solution, a white soluble salt of sodium meta aluminate is obtained.



#### Question 5

What is observed when hot concentrated caustic soda solution is added to

(a) Zinc

(b) Aluminium?

Write balanced equations.

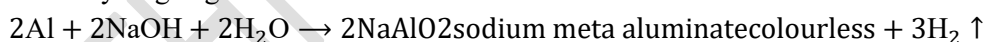
**Answer**

(a) When hot concentrated caustic soda solution is added to zinc, soluble salt of sodium zincate  $[\text{Na}_2\text{ZnO}_2]$  is formed and hydrogen gas is liberated.

The balanced equation is:



(b) When hot concentrated caustic soda solution is added to aluminium, soluble salt of sodium meta aluminate  $[\text{NaAlO}_2]$  is formed and hydrogen gas is liberated.



#### Question 6

Distinguish by adding: Sodium hydroxide solution or ammonium hydroxide solution to

(a) Calcium salt solution and lead salt solution

(b) Lead nitrate solution and zinc nitrate solution

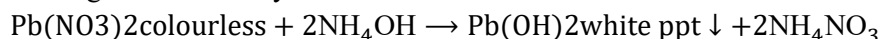
(c) Copper salt solution and ferrous salt solution

(d) Fe(II) salt solution and Fe(III) salt solution

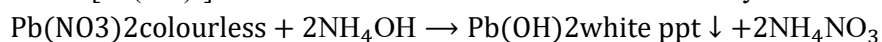
(e) Ferrous nitrate and lead nitrate

**Answer**

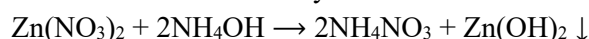
(a) Ammonium hydroxide on reaction with lead salt solution gives chalky white precipitate of  $\text{Pb(OH)}_2$ . No precipitation occurs on adding Ammonium hydroxide to Calcium salt solution even when it is added in excess.



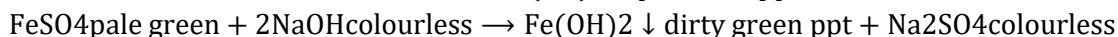
(b) When ammonium hydroxide solution is added to each of the compounds, lead nitrate forms a chalky white precipitate of lead hydroxide  $[\text{Pb(OH)}_2]$  which is insoluble in excess of ammonium hydroxide.



Whereas a gelatinous white precipitate of zinc hydroxide  $[\text{Zn(OH)}_2]$  is formed in case of zinc nitrate, which is soluble in excess of ammonium hydroxide.

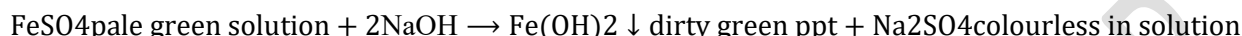


(c) On adding Sodium hydroxide to Copper salt pale blue coloured precipitate is obtained which is insoluble in excess of Sodium hydroxide. Ferrous salt solution gives a dirty green coloured precipitate with Sodium hydroxide which is insoluble in excess of NaOH.

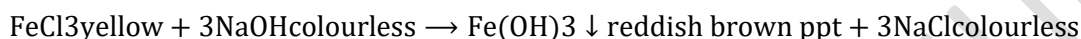


(d) Sodium hydroxide on reaction with Fe(II) salt gives dirty green coloured precipitate, while with Fe(III) salt solution it forms reddish brown precipitate. Both precipitates are insoluble in excess NaOH.

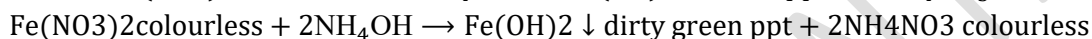
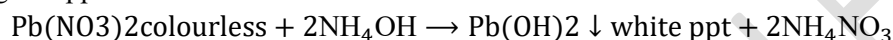
Fe(II) salt:



Fe(III) salt :



(e) Ammonium hydroxide on reaction with lead nitrate gives a chalky white insoluble precipitate, and with ferrous nitrate forms a dirty green ppt.

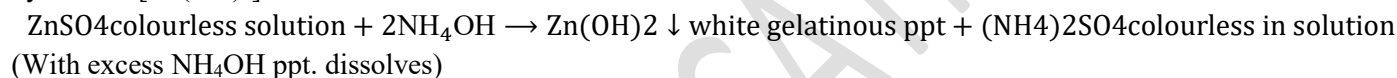


### Question 7

How will you distinguish calcium nitrate and zinc nitrate solution?

**Answer**

When ammonium hydroxide ( $\text{NH}_4\text{OH}$ ) is added to zinc nitrate solution [ $\text{Zn(NO}_3)_2$ ], a gelatinous white ppt of zinc hydroxide [ $\text{Zn(OH)}_2$ ] is obtained which is soluble in excess of  $\text{NH}_4\text{OH}$ .



On the other hand, calcium nitrate solution [ $\text{Ca(NO}_3)_2$ ] does not give any ppt. even when excess of ammonium hydroxide is added.

### Exercise 4 — Long Answer Type

#### Question 1

You are provided with two reagent bottles marked A and B. One contains  $\text{NH}_4\text{OH}$  solution and the other contains NaOH solution. How will you identify them by a chemical test?

**Answer**

Reagent bottles A and B can be identified by using  $\text{Ca(NO}_3)_2$ .

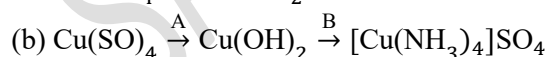
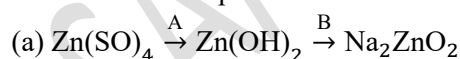
When  $\text{NH}_4\text{OH}$  solution is added to  $\text{Ca(NO}_3)_2$  a white ppt is obtained.



On the other hand, addition of  $\text{NH}_4\text{OH}$  solution to  $\text{Ca(NO}_3)_2$  gives no precipitate even when  $\text{NH}_4\text{OH}$  solution is added in excess. Thus,  $\text{Ca(NO}_3)_2$  can be used to distinguish between  $\text{NH}_4\text{OH}$  and NaOH solution.

#### Question 2

Write balanced equations for the following conversions:

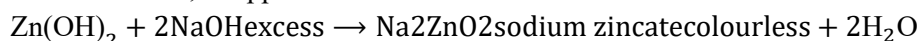


**Answer**

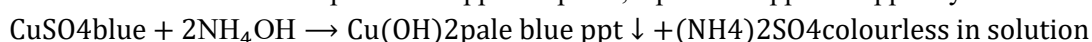
(a) When sodium hydroxide solution is added dropwise to zinc sulphate, a white gelatinous ppt of zinc hydroxide is obtained.



On adding excess of NaOH solution, the ppt dissolves and a colourless solution is obtained.

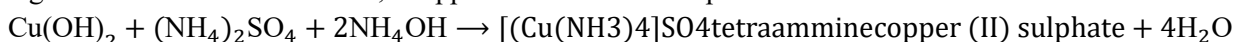


(b) When ammonia solution is added dropwise to copper sulphate, a pale blue ppt of copper hydroxide is obtained.





On adding excess of ammonia solution, the ppt dissolves and a deep blue solution is obtained.



**Question 3**

- (a) What do you understand by amphoteric oxide?
- (b) Give the balanced equations for the reaction with two different amphoteric oxides with a caustic alkali.
- (c) Name the products formed.

**Answer**

- (a) Amphoteric oxides and hydroxides are those compounds which react with both acids and alkalis to form salt and water.
- (b) Balanced equations for the reaction of Zinc Oxide and Lead Oxide with Caustic Soda are given below:  
 $\text{ZnO} + 2\text{NaOH} \rightarrow \text{Na}_2\text{ZnO}_2 + \text{H}_2\text{O}$   
 $\text{PbO} + 2\text{NaOH} \rightarrow \text{Na}_2\text{PbO}_2 + \text{H}_2\text{O}$
- (c) Sodium zincate  $[\text{Na}_2\text{ZnO}_2]$  and sodium plumbite  $[\text{Na}_2\text{PbO}_2]$  are the products formed.

**Question 4**

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.

- (a) From the following list, identify which metal salt solution was used above?  
Na, Al, Zn, Pb, Fe
- (b) What is the formula of the white gelatinous precipitate obtained?
- (c) Give the balanced equation(s) when sulphate of this metal reacts with ammonia solution in excess.

**Answer**

- (a) Zinc (Zn) metal salt solution was used
- (b)  $\text{Zn(OH)}_2$
- (c) The balanced equations are given below:  
 $\text{ZnSO}_4 \text{colourless solution} + 2\text{NH}_4\text{OH} \rightarrow \text{Zn(OH)}_2 \downarrow \text{white gelatinous ppt} + (\text{NH}_4)_2\text{SO}_4 \text{colourless in solution}$   
With excess of  $\text{NH}_4\text{OH}$  ppt. dissolves

