WORKSHEET 2

CHAPTER 4 – ANALYTICAL CHEMISTRY

A. Tick (✓) the correct option.

1. Hot and concentrated caustic alkalis (NaOH, KOH) react with amphoteric metals like aluminium, zinc and lead to liberate
   a. nitrogen gas. b. hydrogen gas. c. sulphur gas. d. none of these.
2. If a light blue precipitate is formed which is soluble in excess ammonium hydroxide forming an ink-blue solution, then the metal cation in the salt solution is
   a. copper(III). b. copper(II). c. iron(II) d. iron(III)
3. The characteristic colour of strontium compounds in fireworks is
   a. blue. b. red. c. orange. d. green.
4. The characteristic colour of calcium compounds in fireworks is
   a. blue. b. red. c. orange. d. green.
5. The characteristic colour of barium compounds in fireworks is
   a. blue. b. red. c. orange. d. green.

B. i. Identify the substances P and Q in each case based on the information given below.

1. The diliquescent salt P, turns yellow on dissolving in water, and gives a reddish-brown precipitate with sodium hydroxide solution.
2. The white crystalline solid Q is soluble in water. It liberates a pungent smelling gas when heated with sodium hydroxide solution.

ii. Give one test each to distinguish between the following pairs of chemicals.

1. Zinc nitrate solution and calcium nitrate solution.
2. Sodium nitrate solution and sodium chloride solution.
3. Iron(III) chloride solution and copper chloride solution.

C. i. Write the observations and balanced equations.

1. Sodium hydroxide is added drop-wise in excess to a solution of zinc sulphate.
2. Ammonium hydroxide is added first in a small quantity and then in excess to a solution of copper sulphate.

ii. Complete the following table which refers to the action of heat on some carbonates:

Carbonate	Colour of residue on cooling
Zinc carbonate	
Lead carbonate	
Copper carbonate	

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D. Copy and complete the following table which summarizes the effect of adding a small amount of sodium hydroxide to various salt solutions followed by an excess of the reagent, and then adding ammonium hydroxide (ammonia solution) in a small amount followed by an excess of the reagent to another sample of each of the salt solutions.

Solution	Effect of adding sodium hydroxide solution		Effect of adding ammonium hydroxide	
	small amount	in excess	small amount	in excess
Calcium nitrate Zinc nitrate Lead nitrate			no precipitate	no change

E. Answer the following.

1. How will you distinguish between the solution of zinc nitrate and lead nitrate with one chemical test? Give relevant equations for the chemical reactions.
2. State your observations and write chemical equations, when copper(II) sulphate solution is first treated with small amount and then in excess with sodium hydroxide solution.
3. State your observations and write chemical equations, when iron(II) chloride solution is first treated with small amount and then excess of ammonium hydroxide.

ANSWERS

WORKSHEET 2

A. Tick (✓) the correct option.

1. b 2. b 3. b 4. c 5. d

B. i. Identify the substances P and Q in each case based on the information given below:

1. P is ferric chloride.
2. Q is an ammonium salt.

ii. Give one test each to distinguish between the following pairs of chemicals.

1.	With NaOH solution	**Zinc nitrate solution** gives white precipitate soluble in excess	**Calcium nitrate solution** gives white precipitate insoluble in excess
2.	With lead nitrate solution	**$NaNO_3$ solution** gives no reaction	**NaCl solution** gives white precipitate which disappears on heating and reappear on cooling
3.	With NaOH solution	**Iron (III) chloride** gives chocolate brown precipitate	**Copper (II) chloride** gives sky blue precipitate

C. i. Write the observations and balanced equations.

1. White precipitate is obtained which is soluble in excess to give clear solution.

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

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

2. Sky blue precipitate is obtained which is soluble in excess to give deep blue inky colouration.

$CuSO_4 + 2NH_4OH \rightarrow Cu(OH)_2\downarrow + (NH_4)2SO_4$

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

ii. Complete the following table which refers to the action of heat on some carbonates:

Carbonate	Colour of residue on cooling
Zinc carbonate	Yellow when hot and white when cold
Lead carbonate	Pale-yellow powder
Copper carbonate	Black powder

D. Copy and complete the following table which summarizes the effect of adding a small amount of sodium hydroxide to various salt solutions followed by an excess of the reagent, and then adding ammonium hydroxide (ammonia solution) in a small amount followed by an excess of the reagent to another sample of each of the salt solutions.

Solution	Effect of adding sodium hydroxide solution		Effect of adding ammonium hydroxide	
	small amount	in excess	small amount	in excess
Calcium nitrate	white precipitate	no change	no precipitate	no change
Zinc nitrate	white precipitate	soluble	white precipitate	soluble
Lead nitrate	white precipitate	soluble	white precipitate	no effect

E. Answer the following.

1. To each of the solution, add ammonium hydroxide first in small amount and then in excess.
   i. In case of zinc nitrate, a white gelatinous ppt. is formed which dissolves in excess of ammonium hydroxide solution to form colourless solution of tetrammine zinc hydroxide.

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

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

   ii. In case of lead nitrate, a chalky-white ppt. of lead hydroxide is formed. This ppt. is insoluble in excess of ammonium hydroxide solution.

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

2. When blue coloured copper (II) sulphate is treated with small amount of sodium hydroxide solution, it forms pale blue ppt. of copper (II) hydroxide.

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

   The pale blue ppt. of $Cu(OH)_2$ is insoluble in excess of sodium hydroxide.

3. When light green iron(II) chloride is treated with small amount of ammonium hydroxide, it forms dirty green ppt. of iron(II) hydroxide.

   $FeCl_2 + 2NH_4OH \rightarrow Fe(OH)_2\downarrow + 2NH_4Cl$

   The dirty green ppt. does not dissolve in excess of ammonium hydroxide.