**545/3 CHEMISTRY**

**Qn1**. You are provided with the following solutions:

BA1: Which is a solution made by dissolving 12.6g of a hydrated compound X.nH2O in

1 litre of solution.

BA2: Is a solution of sodium hydroxide, made by dissolving 8g per litre of solution.

RFM of X is **90.**

Phenolphthalein indicator.

You are required to carry out the experiment, using the solutions, **to determine the number of moles of water of crystallization**, **n**, in a hydrated compound x.NH20.

BA1 reacts with BA2 according to the equation:

**X (aq) + 2NaOH (aq) \_\_\_\_\_\_\_\_ Na2X(aq) +2H2O (*l*)**

**PROCEDURE:**

1. Pipette 25cm3(or 20cm3) of BA1 into a conical flask.
2. Add 2-3 drops of phenolphthalein indicator
3. Titrate it with sodium hydroxide solution from the burette, until the solution just turns pink.
4. Repeat the titration until you get consistent readings.
5. Record your results (readings) in the table below.

**RESULTS:**

Capacity of pipette used: 25.0 cm3. ( Mark)

|  |  |  |  |
| --- | --- | --- | --- |
| Titration number | 1 | 2 | 3 |
| Final burette reading/cm3 | 23:70 | 23.60 | 47.20 |
| Initial burette reading/cm3 | 0.00 | 0.00 | 23.60 |
| Volume of NaOH used/cm3 | 23.70 | 23.60 | 23.60 |

(02 marks)

**CALCULATIONS**:

1. Titre values used for the average of BA2used.

23.60 and 23.60 cm3

( mark )

1. Average volume of NaOH used.

= 23.60 + 23.60

2

= 23.60 cm3

(1)

1. Calculate:
2. The number of moles of sodium hydroxide that reacted.

RFM (NaOH) = (23x1) + (16x1) + (Ix1)

= 23 + 16 + 1

= 40.

40g of NaOH contain 1 mole.

8.0 g of NaOH contain (1 x) moles. (02)

= 0.20 moles.

Molarity of NaOH = 0.20 M.

1000cm3 of NaOH solution contains 0.2 moles

23.60 cm3 of NaOH solution contains (0.2 x)

= 0.00472 moles

Moles of NaOH that reacted =0.00472 moles.

(1marks)

1. The molarity of X.nH2O.

From equation; 1 mole of X.nH20 reacts with 2 moles of NaOH

* Number of moles of X.nH20 that reacted= ( x 0.00472)moles

=0.0236 moles.

* 25cm3 of X.nH20 contains 0.00236 moles.

1000cm3 of X.N H20 contains (0.00236 x) moles (03 marks )

=0.0944 moles.

Molarity of X.nH20 is 0.0944 M.

1. Determine the value of **n** in X.nH2O.

RFM of X.nH20 =

=

=133.5

133.5 (04marks)

* X.nH20 = 133.5

90 + n [(1x2) + (16x1)] = 133.5

90 + n (2+16) =133.5

90 +18n =133.5

18n =133.5- 90

18n =43.5; n=

n =2.416;

n 2.0

(14marks)

**Qn 2.** You are provided with substance **P** which contains **two cations** and **one anion.**

You are required to carry out tests on **P** and identify the cations and onion present.

Identify any gas (es) produced and record down your results in the table below:

|  |  |  |  |
| --- | --- | --- | --- |
| **TEST** | **OBSERVATIONS** | **DEDUCTIONS** | **Marks** |
| a) Heat a spatula endful  of P in a dry clean test tube, first gently and then strongly until no further change | Greenish solid turns into black residue;  Colourless liquid droplets; that turn anhydrous copper (11)  Sulphate crystals blue;  Colourless gas; turns moist red litmus paper blue; | Fe2+ Oxidized to  Fe3+  Hydrated salt/ water of crystallisation  **; NH3(g)** |  |
| b) Dissolve another spatula end ful of P in a test tube in about 10cm3 of water.  Divide the resultant solution into five portions | Faint green/light green solution | **Fe2+** | 01 |
| i) To the first portion, add dilute sodium hydroxide solution, drop wise until in excess, and finally boil. | Dirty green ppt;  Insoluble in excess;  Slowly turns brown on standing.  -Colourless gas; turns moist red. litmus paper blue; | **Fe2+**  **; NH3(g)** | 03 |
| ii) To the second portion, add dilute ammonia solution, dropwise until in excess.  Allow the mixture to stand for about 3minutes. | Dirty green ppt;  Insoluble in excess;  Slowly turns brown on standing. | **Fe2+** | 02 |
| iii) To the third portion in a test tube, add lead (II) nitrate solution; and then boil. | White ppt in soluble on boiling |  |  |
| iv) To the forth portion; add a few drops of silver nitrate solution. | No observable change |  | 01 |
| v)To the fifth portion; add barium nitrate solution, followed by dilute nitric acid | White ppt’ insoluble |  |  |

(c) (i) The **cations** in **P** are:

Fe2+ and ( 1 marks)

1. The **anion** in **P** is

**END**