CHEMISTRY. 02

CODE 032/2A.

(01) Table of results.

Titration	Pilot.	1	2	3
final reading	21.80	40.00	20.10	40.80
initial reading	0.00	20.00	0.00	20.00
volume used.	20.00	20.00	20.10	20.80

Table 04marks

Average volume of acid $= \frac{V_1 + V_2 + V_3}{3}$ $\frac{1}{2}$ mark

$V_2 = \frac{20.00 + 20.10 + 20.80}{3}$ $\frac{1}{2}$ mark

$V_2 = 20.30 cm^3$ 01 mark

(a) Phenolphthalein indicator is not suitable indicator for this titration the reaction involves strong acid against weak base, so if phenolphthalein indicator was used in place of methyl orange indicator we could have not get end point and get wrong volume of acid. 01marks

(b) (i) $\frac{20 cm^3}{\text{reaction.}}$ 01mark of P required $20.30 cm^3$ 01mark of Q for complete

(ii) $HCL_{(aq)} + NH_4OH_{(aq)} \longrightarrow NH_4CL_{(aq)} + H_2O_{(l)}$

02marks

(c) Calculate for the percentage by weight of the impurity in the ammonium hydroxide.

Step 1.

Calculate molarity of acid (Molarity of concentrated)

Molarity of conc (M_c) = $\frac{\text{conc in g/dm}^3}{\text{Molar mass g/mol.}}$ $\frac{1}{2}$ mark

Molarity of conc (M_c) = $\frac{36.5\text{g/dm}^3}{36.5\text{g/dm}^3}$ $\frac{1}{2}$ mark

Molarity of conc (M_c) = 1 mol/dm^3

Molarity of conc. Acid (M_c) of Solution = 1mol/dm^3

1 mark

Then

Calculate Molarity of diluted acid S can be calculated;

From the formula;

$$M_c V_c = M_d V_d$$ $\frac{1}{2}$ mark

Where;

M_c = Molarity of conc. Acid

V_c = Volume of conc. Acid

M_d = Molarity of diluted. Acid

V_d = Volume of diluted or Final volume of acid.

We have

$M_c = 1M$

$V_c = 10\text{cm}^3$

$V_d = 100\text{cm}^3$

$M_d = ?$

$M_c V_c = M_d V_d$

$1M \times 100cm^3 = M_d \times 1000cm^3$ $\frac{1}{2}$ mark

$M_d = \frac{1M \times 10cm^3}{100cm^3}$ $\frac{1}{2}$ mark

$= 0.1M$

Molarity of diluted acid = 0.1M 1 mark

Step 2;

Find the Molarity of base of solution (M_b)

From the relation.

$$\frac{M_a V_a}{M_b V_b} = \frac{n_a}{n_b}$$

Where,

M_a = Molarity of Acid.

V_a = Volume of Acid

M_b = Molarity of Base

V_b = Volume of Base

N_b = Number of Base.

$$HCL_{(aq)} + NH_4OH_{(aq)} \longrightarrow NH_4CL_{(aq)} + H_2O_{(l)}$$

$N_a = 1$ $N_b = 1$ Mole ratio ($\frac{1}{2}$ mark)

We have

$M_a = 0.1M$

$V_a = 20.30 cm^3$

$M_b = ?$

$V_b = 20.00 cm^3$

$n_b = 1$

$n_a = 1$

$$M_b = \frac{M_a \times V_a \times n_b}{V_b \times n_a}$$ $\frac{1}{2}$ mark

$$M_b = \frac{0.1 \times 20.30 \times 1}{20 \times 1}$$ $\frac{1}{2}$ mark

$M_b = 0.1$

$M_b = 0.1M$

Molarity of base (M_b) of solution 0.1M

1 mark

Step 3;

Calculation for percentage purity of base of solution.

Concentration in g/dm^3 of pure = Molarity x Molar mass of (NH_4OH)

$\frac{1}{2}$ mark

Concentration in g/dm^3 of pure = 0.1×35 $\frac{1}{2}$ mark

Concentration in g/dm^3 of pure = $3.5 g/dm^3$ $\frac{1}{2}$ mark

But

Concentration in g/dm^3 of impure solution

Concentration of solution = $\frac{\text{Mass}}{\text{Volume}}$ $\frac{1}{2}$ mark

Conc of P = $\frac{4.0g}{0.25 dm^3}$ $\frac{1}{2}$ mark

Concentration of Impure of solution = $16 g/dm^3$ 1 mark

from.

Percentage purity = $\frac{3.5 g/dm^3}{16 g/dm^3} \times 100\%$ $\frac{1}{2}$ mark

Percentage purity = 21.875% 1 mark

so,

Percentage impure % = 100% - % purity. $\frac{1}{2}$ mark

Percentage impure % = $100\% - 21.875\%$ $\frac{1}{2}$ mark

= 78.125%

∴ Percentage by weight of the Impurity in the ammonium hydroxide = 78.13% 1 mark

(a)

S/N	observation.	inference.
(a)	Pale green (light green) crystalline form	Fe^{2+} may be present
(b)	Sample M soluble forming pale green solution	Fe^{2+} may be present
(c)	No gas evolved	SO_4^{2-} may be present
(d)	Reddish brown residue observed	Fe^{2+} may be present
(e)	(i) Green precipitate was formed, insoluble in excess which turned brown on standing.	Fe^{2+} may be present.
	(ii) White precipitate observed	SO_4^{2-} confirmed.
	(iii) Light blue precipitate observed	Fe^{2+} confirmed.

(05 mark @ 14 marks)

(i) The cation in sample T is Fe^{2+} and anion is SO_4^{2-} 2@ 4marks

(ii) The name of Sample T is Iron (II) Sulphate. 02 marks

(iii) The chemical formula of sample T is $FeSO_4$. 02 marks

(b) When Barium chloride was added to the sample solution white precipitate formed showing that reaction occured between sample T and barium chloride. Precipitate is Barium sulphate. 01½ marks

(c)

$$FeSO_4(aq) + BaCl_2(aq) \longrightarrow FeCl_2(aq) + BaSO_4(s)$$

Sample T

01½ marks.