CHRISTIAN SOCIAL SERVICES COMMISSION
An Ecumenical Body of Tanzania Episcopal Conference and Christian Council of Tanzania
P.O. Box 9433, Dar es Salaam, Tanzania
CSSC-SOUTHERN ZONE FORM FOUR JOINT EXAMINATION

032/2A CHEMISTRY 2A
(MARKING GUIDE)

Time 2:30 hours **AUGUST 2024.**

1.

Burette reading

Experiment	Pilot	1	2	3
Final burette reading (cm^3)	13.00	12.50	12.50	12.50
Initial burette reading (cm^3)	0.00	0.00	0.00	0.00
Volume used (cm^3)	13.00	12.50	12.50	12.50

(04 Marks)

Pipette used was 25 cm^3 and the burette used = 50cm^3 **(01 Marks)**

Note: if 20.00 cm^3 pipette was used the volume of acid will be 10.00 cm^3

$Volume\ volume = \frac{V_1+V_2+V_3}{3}$ **(00 $\frac{1}{2}$ Marks)**

$= \frac{12.50\ cm^3+12.50\ cm^3+12.50\ cm^3}{3}$ **(00 $\frac{1}{2}$ Marks)**

$= \frac{37.50\ cm^3}{3}$

$= 12.50\ cm^3$ **(00 $\frac{1}{2}$ Marks)**

$\therefore The\ mean\ titre\ volume = 12.50\ cm^3$ **(00 $\frac{1}{2}$ Marks)**

(a) (i) Yellow to Orange/Pink. **(01 Mark)**

(ii) 25 cm^3 of solution **G** required 12.5 cm^3 of solution **F_1** **(01 Mark)**

(b) Chemical equation for the reaction between F_1 and G

$$H_2Q_{(aq)} + 2NaOH_{(aq)} \rightarrow 2H_2O_{(g)} + Na_2Q_{(aq)}$$ **(01 Marks)**

(c) (i) **Solution.**

Data given

Mass of F: (m) = $49.0g$; Volume of solution (v) = $1dm^3$
Mass of sodium hydroxide: $NaOH$, (m_1) = $4.00g$; Volume of solution (v) = $1000cm^3$ or $1dm^3$
Molarity of G = ?

Molarity of Base $(M_b) = \frac{Concentration\ of\ base}{Molar\ mass\ of\ NaOH} \Rightarrow \frac{4.00\ g/dm^3}{40g/mol} = 0.1M$

$$\therefore Molarity\ of\ F = 0.1\ M$$

Molarity of F1 = ?

From: $\frac{M_A V_A}{M_B V_B} = \frac{n_A}{n_B}$; but $V_A = 12.5cm^3, V_B = 25cm^3, n_A = 1, n_B = 2, M_b = 0.1M, M_a = ?$

$$M_a = \frac{M_b V_b n_a}{V_a n_b} = \frac{0.1M \times 25cm^3 \times 1}{12.5cm^3 \times 2} = 0.1M$$

$\therefore = Molarity\ of\ F1 = 0.1M$ **(02 Marks)**

Volume of concentrated Acid $(V_c) = 20\ cm^3$
Volume of diluted Acid $(V_d) = 100\ cm^3$
Molarity of diluted Acid $(M_c) = ?$
Then, from; Dilution law $M_c V_c = M_d V_d \Rightarrow M_d = \frac{M_C V_c}{Vd} \Rightarrow \frac{0.1\ M \times 100\ cm^3}{20\ cm^3}$
$\therefore$ Molarity of **F** = $Molarity\ 0.5\ M$

(ii) Molar mass of **F**=?

From: $Molarity = \frac{Concentration}{Molar\ mass} \Rightarrow Molar\ mass = \frac{Concentration}{Molarity} \Rightarrow \frac{49g/dm^3}{0.5Mol/dm^3} = 98\ g/mol$

$\therefore Molar\ mass\ of\ H_2Q = 98\ g/mol.$ **(02Marks)**

(iii) Molecular mass of Q =?

From; $H_2Q = 98\ g/mol; \Rightarrow Q + (1 \times 2) = 98\ g/mol$

$$Q + 2 = 98\ g/mol$$

$$Q = 96$$

$\therefore Molecular\ \ mass\ of\ Q = 96$ **(01 Marks)**

(d) Q is Sulphate ion (SO_4^{2-}) and the formula of F is H_2SO_4 **(02 Marks)**

(e) Properties of **F** which is an acid.

- It turns blue litmus paper red.
- It is corrosive.
- It reacts with metals to liberate hydrogen gas
- It reacts with base to form salt and water.
- It reacts with carbonates to form salt, carbon dioxide and water.
- It reacts with ammonia gas to form ammonium salts
- It has sour taste **(Any two; 1@ =2 Marks)**

Properties of **G** which is a base

- It has a bitter taste
- It turns red litmus paper blue
- Have a soap or slippery feel
- It reacts with acids to form salt and water **(Any two; 1@ =2 Marks)**

(f) It is important to swirl the contents when adding acid in order to mix well the contents with the indicator and Fasten the reaction. **(01Marks)**

(g) The sources of errors

- Using contaminated solution
- Misreading the volume
- Dirty apparatuses **(01@ = 03Marks)**

2.

S/N	OBSERVATIONS	INFERENCES
a)	White powder	NH_4^+, Na^+,Zn^{2+},Ca^{2+},Pb^{2+} may be present
b)	No gas evolved	SO_4^{2-} of Na^+, Ca^{2+}, Pb^{2+} may be present
		Cl^- of Na^+, Pb^{2+} may be present
		CO_3^{2-} of Na^+ may be present
	Residue reddish brown when hot and yellow when cold	Pb^{2+} may be present
c)	Colourless gas evolved, which forms white dense fumes with ammonia gas.	Cl^- may be present
d)	Insoluble in cold water but soluble in hot water. Crystals reappear on cooling.	Cl^- of Pb^{2+} may be present
	i) White precipitates were formed, insoluble in excess	Pb^{2+} may be present
	ii)Yellow precipitates were formed which disappear on warming but re-appears on cooling	Pb^{2+} confirmed
	iii) White precipitates were formed	Cl^- confirmed

(16 Marks = @ 01Mark)

Conclusion

a) (i) The cation in sample **R** is $\underline{Pb^{2+}}$ *01Mark*

(ii) The anion in sample **R** is $\underline{Cl^-}$ *01Mark*

(iii) The chemical formula of sample **R** is $\underline{PbCl_2}$ *1.5Mark*

(iv)The chemical name of sample **R** is Lead (II) chloride *1.5Mark*

b) With state symbols, write the balance chemical reaction that took place between the chemical formula in sample **R** in (iii) and silver nitrate

$PbCl_{2(s)} + 2AgNO_{3\ (aq)} \longrightarrow 2AgCl_{(s)} + Pb(NO_3)_{2(aq)}$ *02Marks*

c) Mention two uses of a group of salt of sample **R** in daily life process (any two points)

i. It used in house hold especially sodium chloride as food additive for taste.
ii. It used by dentist to cement the cavities of teeth eg $MgCl_2$. 03 marks @ 1.5 mark
iii. It used in the manufacture of dry batteries eg. Zinc chloride with the mixture of ammonium chloride. *02Marks*