FORM SIX INTER-ISLAMIC MOCK EXAMINATION

MARKING GUIDE

CHEMISTRY 3A:

01 - Volume of pipette used was $25cm^3$
- Volume of the burette used was $50cm^3$

Burette readings

Titration number	Pilot	1	2	3
Final volume(cm^3)	16.50	32.70	16.20	16.20
Initial volume (cm^3)	0.00	16.50	0.00	0.00
Volume used (cm^3)	16.50	16.20	16.20	16.20

(03 marks)

Average volume $= \frac{V_1 + V_2 + V_3}{3}$ (00½ marks)

$= \frac{(16.20 + 16.20 + 16.20)cm^3}{3}$

$= 16.20cm^3$ (00½ marks)

∴ The average volume of KMnO4 used is $16.20cm^3$

Summary;
$25.00 cm^3$ of solution B_2 required $16.20cm^3$ of B_1 in the presence of B_3 for complete reaction. (01 mark)

(a) (i) Reduction of MnO_4^-

$MnO_{4(aq)}^- + 8H_{(aq)}^+ + 5\bar{e} \longrightarrow Mn^{2+}_{(aq)} + 4H_2O_{(l)}$ (01 mark)

Oxidation of $C_2O_4^{2-}$

$C_2O_4^{2-} \longrightarrow 2CO_2 + 2\bar{e}$ (01 mark)

(ii) H_2SO_4 was added initially in $Na_2C_2O_4$ to give acidic medium for the reaction to take place as well as form oxalic acid. (01 mark)

(iii) The solution mixture was warmed then titred while hot so as to increase the rate of reaction (i.e oxalate formation) (01 mark)

01 (b) (i) Molarity of B_2 from Concentration = $\frac{\text{mass}}{\text{volume}}$ (00½ mark)

$= \frac{4.00\,g}{0.25\,dm^3}$

$= 16.0\,g/dm^3$ (00½ mark)

then, Molarity = $\frac{\text{Concentration}}{\text{Molar mass}}$ (00½ mark)

$= \frac{16\,g/dm^3}{134\,g/mol}$ (00½ mark)

$= 0.12\,mol/dm^3$

∴ The molarity of B_2 is 0.12M. (00½ mark)

(ii) Molarity of B_1

from, $\frac{M_{MnO_4^-} V_{MnO_4^-}}{M_{C_2O_4^-} V_{C_2O_4^{2-}}} = \frac{n_{MnO_4^-}}{n_{C_2O_4^{2-}}}$ (00½ mark)

$M_{MnO_4^-} = \frac{M_{C_2O_4^{2-}} \times V_{C_2O_4^{2-}} \times n_{MnO_4^-}}{V_{MnO_4^-} \times n_{C_2O_4^{2-}}}$ (00½ mark)

$= \frac{0.119M \times 25cm^3 \times 2mol}{16.20cm^3 \times 5mol}$ (01 mark)

$= 0.0737M$.

∴ The molarity of B_1 is 0.0737M. (01 mark)

(iii) Concentration of pure B_1 in g/dm^3.

From, Molarity = $\frac{\text{Concentration}}{\text{Molar mass}}$ (00½ mark)

Concentration = Molarity × Molar mass

$= 0.0737M \times 158\,g/mol$

$= 11.6\,g/dm^3$ (00½ mark)

∴ The Concentration of pure B_1 is $11.6\,g/dm^3$

01 (b) (iv) Percentage purity of $KMnO_4$.

soln:

$$\text{Percentage purity} = \frac{\text{Concentration of pure}}{\text{Concentration of impure}} \times 100\% \quad (00\tfrac{1}{2} \text{ mark})$$

but Concentration of impure $= \frac{\text{mass (impure)}}{\text{Volume}}$ $(00\frac{1}{2}$ mark)

$$= \frac{5g}{0.25dm^3}$$

$$= 20g/dm^3 \quad (00\tfrac{1}{2} \text{ mark})$$

then; Percentage purity $= \frac{11.6\,g/dm^3}{20\,g/dm^3} \times 100\%$ $(00\frac{1}{2}$ mark)

$$= 58.23\%$$

∴ Percentage purity of $KMnO_4$ is 58.23% (01 mark)

(v) Percentage impurity of $KMnO_4$.

soln

Percentage purity + percentage impurity = 100%

Percentage impurity = 100% − % purity (01 mark)

$$= (100 - 58.23)\%$$

$$= 41.77\%$$

∴ The percentage impurity is 41.77 % (01 mark)

02

Table of results

S/N	t (sec)	$\frac{1}{t}$ (sec^{-1})	[P1] M
1	68	0.015	0.161
2	97.68	0.010	0.129
3	120.89	0.008	0.097
4	207.13	0.005	0.64

(06 marks)

NOTE:
The molarity of P1 is obtained by calculating the initial concentration of P1 (molarity) then equate it with the volume of P1 measured;-

4. Example.

$0.16M \longrightarrow 10ml$

$x \longleftarrow 8mm$

$$x = \frac{0.16M \times 8ml}{10ml}$$

$$= 0.129M.$$

(a) The graph of $[P_1]$ against time (sec) refers
(b) to the graph paper attached
The graph of $\frac{1}{t}$ (sec^{-1}) against $[P_1]$ refers to the graph paper attached

(c)(i) From the graph (a) as Concentration increase the time for cross W to disappear decrease. This indicate that the rate of reaction increase as concentration increase. (01mark)

(ii) The order of reaction is first order.
reason: Concentration and rate varies direct proportional.
(01 mark)

Q3

	EXPERIMENT	OBSERVATION	INFERENCE
a	Appearance	Yellow crystal observed with chocking smell (0½)	Fe^{2+} and NH_4^+ may be present (0½)
(b)	Heat a little of sample T in a dry test tube	A colourless gas with chocking smell which turn wet red litmus paper blue evolved, Also white sublimate on the cooler part of the tube formed perish brown residue (0½)	NH_4^+, Fe^{2+} or Fe^{3+} may be present. (0½)
(c)	Dissolution of sample T on water	Soluble in cold water and forma colourless solution (0½)	Cl^-, SO_4^{2-}, CO_3^{2-} Na^+, K^+, NH_4^+ may be present (0½)
	(i) Addition of NaOH solution and warm gently	Green precipitate was formed (0½)	Fe^{2+}, Cr^{3+}, Ni^{2+} may be present (0½)
	(ii) Addition of $AgNO_3$ solution till in excess	White precipitate formed (0½)	Cl^- present and Confirmed (01)
	(iii) Addition of ethanoic acid followed by lead ethanoate solution	No changes observed (0½)	SO_4^{2-} absent
	(iv) Addition of few drops of Potassium hexacyanoferrate(III)	Deep blue colour Precipitate was formed. (0½)	Fe^{2+} confirmed (01)
(d)	Addition of dilute Sodium hydroxide solution followed by heating	- Colourless gas evolved which turn moist litmus paper from red to blue. (0½)	NH_4^+ confirmed (01)

0.3 Conclusion

(i) Cation present in sample T are NH_4^+ and Fe^{2+} (02 marks @ 1mark).

(ii) The molecular formula of sample T are NH_4Cl and $FeCl_2$. (02 marks)

(iii) The reaction in experiment (d) is

$$NH_4Cl_{(aq)} + NaOH_{(aq)} \longrightarrow NaCl_{(aq)} + NH_{3(g)} + H_2O_{(l)}$$

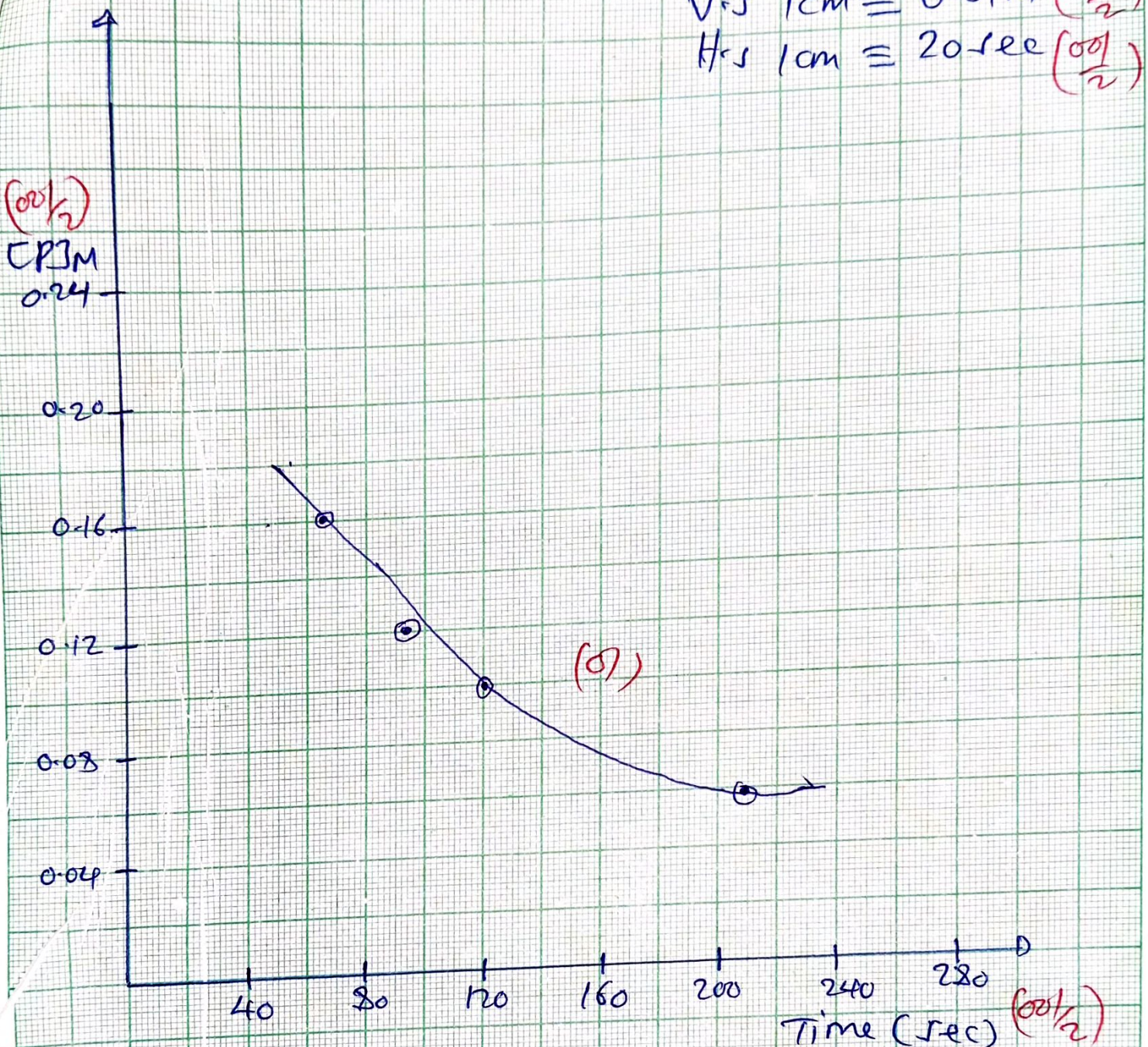
(02 marks)

(a) THE GRAPH OF [P$_i$] AGAINST TIME t (sec). (02½)

Scale:

V-s 1cm ≡ 0·01M (00½)

H-s 1cm ≡ 20 sec (00½)



(1 cm x 1 cm)squares of (10mm x 10mm)

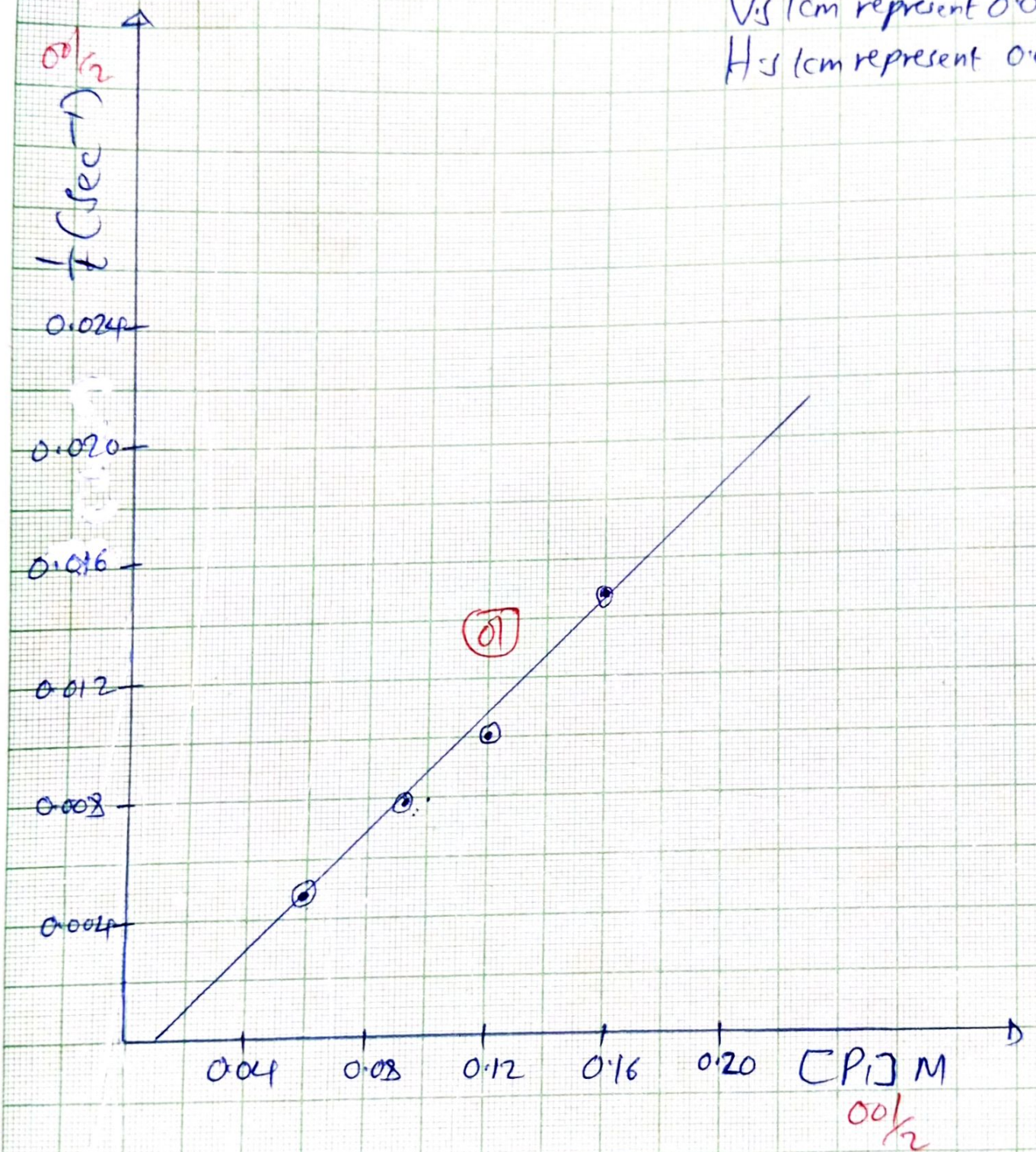
2(b) THE GRAPH OF $\frac{1}{t}$ (sec^{-1}) AGAINST [P_i]

(00½)

scale

V.s 1cm represent 0·0025 (01½)

H.s 1cm represent 0·02M (00½)



(1 cm x 1 cm)squares of (10mm x 10mm)