THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
DIPLOMA IN SECONDARY EDUCATION EXAMINATION

732/2A **CHEMISTRY 2A**

(ACTUAL PRACTICAL A)

Time: 3 Hours **ANSWERS** **Wednesday, 17th May 2011 a.m**

Instructions.

1. This paper consists of **three (3)** questions.
2. Answer **all** questions
3. Question number 1 carries 20 marks and the rest carry 30 marks.
4. Cellular phones are **note** allowed in the examination room.
5. Write your **examination Number** on every page of your answer booklet(s).

1. **Table 1: Titration results**

Titration No.	Trial	1	2	3
Final volume (cm^3)	23.6	47.2	70.8	94.4
Initial volume (cm^3)	0.0	23.6	47.2	70.8
Volume used (cm^3)	23.6	23.6	23.6	23.6

(a) (i) Determine the average titre value.

Average titre value = (23.6 + 23.6 + 23.6 + 23.6) / 4
= 23.6 cm^3

(ii) Write the half Redox reaction equation between ZA and ZB.

For $KMnO_4$:
$MnO_4^- + 8H^+ + 5e^- \text{-----> } Mn^{2+} + 4H_2O$

For Fe^{2+}:
$Fe^{2+} \text{-----> } Fe^{3+} + e^-$

(iii) Write the Net Redox reaction equation for this experiment.

$MnO_4^- + 5Fe^{2+} + 8H^+ \text{-----> } Mn^{2+} + 5Fe^{3+} + 4H_2O$

(iv) State the indicator used, its colour and which one was reduced.

Indicator: $KMnO_4$ acts as a self-indicator.
Colour: Purple to colourless.
Reduced species: MnO_4^- is reduced to Mn^{2+}.

(b) (i) Calculate the concentration of $KMnO_4$ in g/dm^3.

Molarity = 0.02 M
Molar mass of $KMnO_4$ = 158.04 g/mol

Concentration = 0.02 × 158.04
= 3.1608 g/dm^3

(ii) Calculate the concentration of $FeSO_4 \cdot 7H_2O$ in mol/dm^3.

From the balanced equation:
$1MnO_4^-$ reacts with $5Fe^{2+}$
$M_1V_1/n_1 = M_2V_2/n_2$

$0.02 \times 23.6 / 1 = M_2 \times 25 / 5$

$M_2 = (0.02 \times 23.6 \times 5) / 25$
= (2.36) / 25
= 0.0472 M

(iii) Concentration of $FeSO_4$ in g/dm^3

Molar mass of $FeSO_4 \cdot 7H_2O$ = 278.01 g/mol

Concentration = 0.0472 × 278.01
= 13.12 g/dm³

2. **Table 2.2: Experimental results**

Experiment No.	Vol. of PS (cm^3)	Vol. of PQ (cm^3)	Vol. of H_2O (cm^3)	Time t (s)	1/t (s^{-1})
1	2	8	10	60	0.0167
2	4	8	6	42	0.0238
3	6	8	4	30	0.0333
4	8	8	2	24	0.0417

(a) Write a balanced chemical equation for the reaction between PQ and PR.

$Na_2S_2O_3 + 2HCl$ -----> $2NaCl + SO_2 + S + H_2O$

(b) What is the reaction product which causes the solution to cloud the letter Y?

Precipitated sulphur (S) causes the cloudiness.

(c) Calculate the order of reaction with respect to the concentration of the acid.

Since volume of HCl is constant in each experiment, its effect cannot be directly determined from this set. You'd need to vary acid concentration while keeping $Na_2S_2O_3$ constant. From given, order = 1 (from standard reaction kinetics for this system).

3. **Qualitative analysis of Compound J**

S/N	Test	Observation	Inference
(a)	Appearance	White crystalline solid	Ionic salt possible
(b)	Flame test	Yellow flame	Sodium ion (Na^+) present
(c)	Solubility	Soluble in water	Soluble salt
(d)	Action with heat	No visible change	Thermally stable
(e)	Action with dilute H_2SO_4	Effervescence, colourless gas evolved	Carbonate (CO_3^{2-}) present

(f)	Action with concentrated H_2SO_4	Vigorous effervescence	Confirms carbonate
(g)	Action with aqueous NaOH	No precipitate	Na^+ confirmed
(h)	Action with aqueous NH_3	No precipitate	Confirms Na^+
(i)	Action with potassium iodide	No reaction	No Pb^{2+} or Ag^+
(j)	Action with potassium iodide + heat	No reaction	Same
(k)	Action with $FeSO_4$ + conc H_2SO_4	Effervescence (CO_2 gas evolved)	CO_3^{2-} confirmed

Conclusion

(i) The cation and anion
Cation: Na^+
Anion: CO_3^{2-}

(ii) Chemical formula of J
Na_2CO_3

Three ionic equations

(i) Action with heat
$CO_3^{2-} + 2H^+$ -----> $CO_2 + H_2O$

(ii) Reaction with aqueous NaOH
$Na^+ + OH^-$ -----> No precipitate

(iii) Reaction with $FeSO_4 + H_2SO_4$
$CO_3^{2-} + 2H^+$ -----> $CO_2 + H_2O$