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

732/2A **CHEMISTRY 2A**
(ACTUAL PRACTICAL A)

Time: 3 Hours **Thursday, 16th May 2013 a.m.**

Instructions

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question 1 carries **forty (40)** marks and the rest carry **thirty (30)** marks each.
4. A qualitative analysis guide pamphlet may be used.
5. Cellular phones are **not** allowed in the examination room.
6. Mathematical tables and non-programmable calculators may be used.
7. Write your **Examination Number** on every page of your answer booklet(s).
8. The following constants might be useful in your calculations:

   Atomic masses:

   H = 1; C = 12; O = 16; Na = 23; S = 32; K = 39; Mn = 55.

   1 Litre = $1dm^3 = 1000cm^3$.

1. You are provided with the following requirements for experiment:

HH: A solution made by diluting 3 cm^3 of hydrogen peroxide with distilled water to make a 750 cm^3 of solution.

PP: A solution of potassium permanganate ($KMnO_4$) made by dissolving 3.16g in 500 cm^3 of solution.

SS: Dilute sulphuric acid (2M H_2SO_4).

Procedure

- Fill up the burette with solution **PP.**
- Pipette out 25 cm^3 (or 20 cm^3) of solution **HH** into a conical flask and add to it 15 cm^3 of solution **SS.**
- Titrate the solution mixture in (ii) against solution **PP** until the end point is reached.
- Repeat procedures above so as to get three more readings.

Questions

(a) Present your data as shown in Table of Titration results.

(i) Table 1: Titration results.

Titration No.	Trial	1	2	3
Final volume (cm^3)				
Initial volume (cm^3)				
Volume used (cm^3)				

(ii) State clearly what you have observed in terms of colour change at the end point.

(iii) Find the average titre volume.

(b) Write:

(i) The half- reaction equations for the reacting species.

(ii) Net ionic equation for this experiment.

(c) Calculate the:

(i) Molarity of potassium permanganate.

(ii) Concentration of potassium permanganate in g/dm^3.

(iii) Molarity of the diluted solution of hydrogen peroxide.

(iv) Concentration of the original solution of hydrogen peroxide in g/dm^3.

(v) Concentration of the original solution of hydrogen peroxide in mol/dm^3.

2. You are provided with the following solutions:

ST: 0.18 M $Na_2S_2O_3$ (sodium thiosulphate) solution;

HC: 0.5 M HCl;

Distilled water;

Stopwatch;

Small beaker (50cm^3);

Two 10 cm^3 measuring cylinders.

Theory

The effect of concentration on rate of reaction can be investigated using the reaction of sodium thiosulphate and hydrochloric acid. The rate can be expressed thus:

$$-\frac{d[S_2O_3^{2-}]}{dt} = k[S_2O_3^{2-}]^x\ [HCl]^y,$$

where the integer x and y are orders of reaction with respect to thiosulphate concentration and acid concentration respectively.

Procedure

(i) Use a blue pen (**not a marker pen**) to write the letter **"M"** on a piece of white paper and place a small beaker on top of it so that the mark is clearly seen from the top of the beaker.

(ii) Using a 10 cm^3 measuring cylinder (or burette) measure out 4 cm^3 of **ST** and 6 cm^3 of distilled water, and put them in the small beaker (50 cm^3) on top of letter "**M**".

(iii) Using another 10 cm^3 measuring cylinder (or burette) measure out 10 cm^3 of **HC** and at a convenient time pour **HC** into the beaker containing **ST** and distilled water, and immediately start the stopwatch.

(iv) Record the time taken for precipitations to obscure completely the mark "**M**" through the beaker.

(v) Repeat the experiment with other concentrations as shown in Table 2.1.

Table 2.1: Summary of procedure

Exp. No.	Vol. of $Na_2S_2O_3$ (cm^3)	Vol. of distilled H_2O (cm^3)	Vol. of HCl (cm^3) (HC)
1	4	6	
2	6	4	10
3	8	2	10
4	10	0	10
			10

Record your results in tabular form as shown in Table 2.2

Table 2.2: Experimental results

Exp. No.	Vol. of $Na_2S_2O_3$ (cm^3)	Time t (s)	$\frac{1}{t}(s^{-1})$
1	4		
2	6		
3	8		
4	10		

Questions:

Assuming that the volumes of individual solutions are directly proportional to their concentrations:

(a) Write a balanced ionic equation for the reaction in this experiment.

(b) Find the value of **x**.

(c) Given that the value of **y** = 2, find the value of **k**.

(d) Determine an overall order of the reaction.

(e) What is the effect of concentration of $S_2O_3^{2-}$ and [HCl]?

(f) From the results, what conclusion can be drawn?

(g) State two ways that might be used to speed up this reaction.

3. You are given sample of compound **K** which contains **one cation** and **one anion.**

(a) Carry out a qualitative analysis to identify the cation and anion present in salt using the tests provided in Table 3.

Table 3: Qualitative analysis tests

S/N	Test	Observation	Inferences
(a)	Appearance		
(b)	Action of Heat		
(c)	Solubility		
(d)	Action with dil. H_2SO_4		
(e)	Action with conc. H_2SO_4		
(f)	Action with sodium hydroxide solution		
(g)	Action with ammonium solution		
(h)	Action with ammonia thiocyanate/ potassium thiocyanate OR potassium ferricyanide.		
(i)	Confirmatory test for cation by silver nitrate solution, followed by ammonia solution.		

(b) Write a summary of the results indicating the following:
(i) The cation and anion.
(ii) Molecular formula of a salt.

(c) Write the ionic equation to illustrate what took place at test (e), (f) and (i).