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



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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/$dm^3$.



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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.



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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.

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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).



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