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

732/2B

CHEMISTRY 2B
(ACTUAL PRACTICAL B)

Time: 3 Hours DR. MYOTA F. CR **Wednesday, 18th May 2011 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 for answering question number 3 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 = $1dm^3 = 1000cm^3$.

   Gas constant, R = 8.314 $Jmol^{-1}$.

1. The following requirements were provided for experiment:

A: a solution made by dissolving 7. 15g of hydrated sodium carbonate ($Na_2CO_3.W$) in distilled water to make 250 cm^3 of a solution mixture;

B: a solution of 3.65g/dm^3 hydrochloric acid;

C: methyl orange indicator.

Procedure:

(i) Fill the burette with solution **B**.

(ii) Pipette out 10 cm^3 of solution **A** into a titration flask.

(iii) Add 2 – 3 drops of C into **A**.

(iv) Titrate **B** against solution **A** until permanent colour change occurs.

(v) Repeat procedure (i) and (iv) three more times.

(vi) Record your results in tabular form as shown in the Table

Table 1: Titration results

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

Questions:

(a) Find the average titre value for this experiment.

(b) Write a balanced chemical equation for this reaction.

(c) Why was methyl indicator used in this practical?

(d) Calculate the concentration of Na_2CO_3 in:
(i) mol/dm^3
(ii) g/dm^3

(e) Determine the value of **W** in the formula $Na_2CO_3.WH_2O$).

(f) State three uses of this titration.

You are provided with the following:

F: A solution of 0.05M sodium thiosulphate ($Na_2S_2O_3$);

H: A solution of 0.1M HNO_3;

Stop watch;

Two Thermometers.

Theory:

Sodium thiosulphate reacts with dilute hydrochloric acid to precipitate amorphous, white sulphur. The reaction equation is:

$$Na_2S_2O_{3(aq)} + 2H_3O^+_{(aq)} \rightarrow S_{(s)} + SO_{2(g)} + 3H_2O_{(l)}$$

The white precipitates of sulphur causes the solution to become opaque (i.e. not visible). The rate of formation of precipitates can be determined through measuring the time taken for the solution to become invisible.

Procedure:

(i) Place the beaker containing about 150 cm^3 of tap water into a 200 cm^3. Maintain the temperature of water at above 80 ^{0}C. This is your water bath.

(ii) Use a blue or black pen to write a letter "U" on a white piece of paper.

(iii) Place empty beaker (100cm^3) on top of the written letter such that the letter is visible through the clear solution.

(iv) Using a 10cm^3 measuring cylinder (or burette) measure exactly 10 cm^3 of **F** and 10 cm^3 of **H** into separate test tubes.

(v) Put the two boiling test tubes containing **F** and **H** into water bath and warm the content to about 50°C. Use different thermometers so as to avoid the two chemicals to contact.

(vi) Immediately pour the hot solution **F** and **H** in the small beaker, and quickly start the Stop watch. Record the time taken for the letter **U** to disappear completely.

(vii) Repeat procedure (i) - (vi) using temperature of 60°C, 70°C and 80°C.

(viii) Record your results and complete Table 2.

Table 2: Experimental results

Temperature		Time of reaction (s)	$\frac{1}{T}(K^{-1})$	$\frac{1}{t}(s^{-1})$	log
T(°C)	T (K)				
50°C					
60°C					
70°C					
80°C					

Questions:

(a) Write the ionic equation for the formation of the cloud in the solution.

(b) Plot a graph of $\log\frac{1}{t}$ against $\frac{1}{T}$, and find the slope of the graph.

(c) Use the relation: slope = $\frac{-Ea}{2.303R}$ to determine the activation energy, Ea of the reaction

3. Sample **Q** is a simple salt containing one **cation** and one **anion**. Apply systematic qualitative analysis procedure to identify the ions, and hence give the **formula** and **name** of the salt.