THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL
ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

132/3A

CHEMISTRY 3A
ACTUAL PRACTICAL A
(For Both School and Private Candidates)

Time: 3:20 Hours **Wednesday, 04th May 2016 a.m.**

Instructions

1. This paper consists of **three (3)** questions. Answer **all** the questions.
2. Question number **one (1)** carries 20 marks and the other **two (2)**, 15 marks each.
3. Mathematical tables and non programmable calculators may be used.
4. Cellular phones are **not** allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet(s).
6. You may use the following constants:
   - Atomic masses: H = 1, C = 12, O = 16, Na = 23, Mg = 24, S = 32, Cl = 35.5, K = 39, Mn = 55.
   - Molar gas constant = 8.314 J $K^{-1}mol^{-1}$.

1. You are provided with the following:

RR: A solution made by dissolving 0.7 g of potassium permanganate in 0.25 dm^3 of distilled water;

SS: A solution made by dissolving 3.15 g of oxalic acid crystals ($H_2C_2O_4.xH_2O$) in 0.5 dm^3 of distilled water;

TT: A solution of 1 M sulphuric acid;

Thermometer.

Procedure:

(i) Put **RR** into a burette.

(ii) Pipette 20 cm^3 or 25 cm^3 of **SS** into a clean conical flask. Add to it 25 cm^3 of **TT** and heat the mixture solution till the solution attains a temperature of about 70°C.

(iii) Titrate **RR** against the hot solution containing **SS** and **TT** till the colour change from colourless to pink.

(iv) Repeat steps (i) to (iii) three times and record the results in a tabular form.

Results:

The volume of the burette used was _____ cm^3.

The volume of the pipette used was _____ cm^3.

Summary:

_____ cm^3 of **RR** required _____ cm^3 of **SS** in the presence of **TT** for complete reaction.

Questions:

(a) (i) Write the half ionic equation for the reduction of MnO_4^- in the presence of the acid **TT**.

(ii) Write the half ionic equation for the oxidation of $C_2O_4^{2-}$ ions.

(iii) Write the overall balanced redox ionic reaction equation in this particular experiment.

(b) Explain why the end point was pink in colour.

(c) Calculate the;

(i) Molarity of **RR**,

(ii) Molarity of **SS**,

(iii) Concentration of oxalic acid in gdm^{-3},

(iv) Value of x in the compound $H_2C_2O_4.xH_2O$,

(v) Molar mass of **SS**.

2. You are provided with the following:

CM_1: 0.2 M $Na_2S_2O_3$ solution;
CM_2: 0.1 M HCl solution;
CM_3: Distilled water;
CM_4: Piece of white paper marked "X";
Stop watch.

Theory:

The rate of reaction between thiosulphate ion and an acid is given by: Rate of reaction $= \frac{-\partial[S_2O_3^{2-}]}{\partial t} = K[S_2O_3^{2-}]^m[H^+]^n$, where m is the order of reaction with respect to $S_2O_3^{2-}$ and n is the order of reaction with respect to H^+.

Procedure:

(i) Place a 100 cm^3 beaker on **CM_4** in such a way that, a mark X is clearly seen through the bottom of the beaker.

(ii) Using 10 mls measuring cylinder, measure 2 mls of **CM_1** and 8mls of **CM_3** and put them in the 100 cm^3 beaker placed on top of **CM_4**.

(iii) Using another 10 mls measuring cylinder, measure 10 mls of **CM_2** and at a convenient time pour **CM_2** into a beaker containing **CM_1** and **CM_3** and immediately start stopwatch. Record the time taken for the letter "X" to disappear. In each reaction make sure that, the mixture for the total volume of solution is 20 mls.

(iv) Repeat the experiment for other concentrations as shown in Table 1.

Table 1

Experiment	Sodium thiosulphate (cm^3)	Water (cm^3)	Hydrochloric acid (cm^3)
A	2	8	10
B	4	6	10
C	8	2	10

(v) Tabulate your results as shown in the Table 2.

Table 2: Table of results

Experiment	Sodium thiosulphate (cm^3)	Time (sec)	$\frac{1}{\text{time}}$ (sec^{-1})
A	2		
B	4		
C	8		

Questions

(a) Calculate the value of m.
(b) Write the ionic equation in this experiment.
(c) Given that the value of n = 2, find the value of K.
(d) From the experiment above, is it possible to find the value of n? Give reason for your answer.
(e) What causes the precipitations to take place in the reaction?

3. Sample **X** contains a common cation and two anions. Use the information given in the experiment column in Table 3 to complete the observations and inferences and hence identify the common cation and the two anions.

Table 3

S/n	Experiment	Observations	Inferences
1	Observe the appearance of the sample **X**.		
2	Heat small portion of sample X in a dry test tube.		
3	Place a spatulaful of sample **X** in a test tube; add concentrated sulphuric acid.		
4	Place a spatulaful of sample **X** in a test tube and add sodium hydroxide solution.		
5	Prepare a solution of X and divide it into two portions.		
	(i) In the first portion add barium chloride.		
	(ii) In the second portion add silver nitrate solution.		

Conclusion

(a) Write down the ionic equations which took place in stage 4 and 5 (i) above.

(b) The cation in sample **X** is _____ and the anions are _____ and _____.