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

032/2C

CHEMISTRY 2C
ACTUAL PRACTICAL C
(For Both School and Private Candidates)

Time: 2:30 Hours **Wednesday, 18th November 2015 a.m.**

Instructions

1. This paper consists of **three (3)** questions. Answer **all** the questions.
2. Question 1 carries **twenty (20)** marks and the rest carry **fifteen (15)** marks each.
3. Qualitative Analysis Guidance Pamphlets may be used after a thorough check by the supervisor.
4. Cellular phones and calculators 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, Cl = 35.5, S= 32, Ca = 40.
   1 litre = 1 dm^3 = 1000 cm^3

1. A large volume of water has been contaminated with acid. Before the contaminated water can be disposed off, the acid must be neutralized by adding calcium carbonate.

$CaCO_{3(s)} + 2H^{+}_{(aq)} \longrightarrow Ca^{2+}_{(aq)} + H_2O_{(l)} + CO_{2(g)}$.

You are required to determine the concentration of hydrogen ions present in the contaminated water and then calculate the mass of calcium carbonate needed to neutralize all the acid.

Solution **R** is a sample of the contaminated water.
Solution **L** is 0.1 M sodium hydroxide.
Solution **MO** is methyl orange indicator.

Procedures

(i) Put **R** into the burette.
(ii) Pipette 25 cm^3 or 20 cm^3 portion of **L** into a flask and titrate with **R**, using the MO provided.
(iii) Perform three or more titrations and record the results in a tabular form.

Questions

(a) Summary: _____ cm^3 of the average volume of **R** required _____cm^3 of **L** for complete neutralization.

(b) The colour change at the end point was from _____ to _____.

(c) Calculate:
  (i) The concentration of hydrogen ions in $moldm^{-3}$.
  (ii) The number of moles of hydrogen ions present in 10,000 dm^3 of contaminated water.
  (iii) The minimum mass of calcium carbonate needed to neutralize all the acid in 10,000 dm^3 of contaminated water.

2. You are provided with the following:
  C_1: 0.05 sodium thiosulphate;
  C_2: 1 M hydrochloric acid;
  Thermometer;
  Stop watch/clock;
  Plain paper marked **X**.

Procedures

(i) Using a measuring cylinder, measure out 10.0 cm^3 portion of solution C_1 and 10.0 cm^3 of solution C_2 into two separate test tubes.
(ii) Put the two test tubes in a hot water bath. Use a beaker of 250 cm^3 or 300 cm^3 containing 200 cm^3 of water as water bath.
(iii) Place a small beaker (100 cm^3) on top of the letter X drawn on a white plain paper.
(iv) When the solutions attain a temperature of 60°C, pour the contents of C_1 and C_2 into the small beaker placed on top of the letter X and immediately start the stop watch.
(v) Look through the mixture from above and note the time taken for the letter X to disappear.
(vi) Repeat steps (i) to (v) at a temperature of 50°C, 40°C and at the room temperature.
(vii) Record your results as shown in Table 1.

Table 1

Experiment	Temperature	Time/sec
1	60	
2	50	
3	40	
4	Room temperature	

Questions

(a) What is the aim of this experiment?

(b) Complete Table 1.

(c) Write a balanced ionic equation between C_1 and C_2.

(d) Giving reason(s), identify the experiment in which the reaction was:
(i) fast
(ii) slow.

(e) List any three factors which affect the rate of chemical reaction.

(f) Plot a graph of concentration against time.

(g) Comment on the shape of the graph.

3. You are provided with a beaker labeled **A**, containing an unknown acid and a watch glass containing unknown metal **M**. Carry out the experiments indicated in the table below and finally identify the unknown metal **M** and the acid in the beaker **A**.

Table 2: Table of results

S/n	Experiment	Observations	Inferences
1	To about 5 mls of solution **A** in a test tube, add a piece of **M** and warm the mixture gently until the reaction begins and test the gas evolved.		
2	When the reaction is complete, filter if necessary and divide the colourless solution into four portions and use them for further experiment. (i) To one portion of the solution in a test tube, add aqueous sodium hydroxide till excess. (ii) To the second portion, add aqueous ammonia solution till in excess. (iii) To the third portion add potassium hexacyanoferrate (II) till in excess. (iv) To the fourth portion add silver nitrate solution followed by aqueous ammonia solution.		

Questions

(i) What acid was present in a beaker?
(ii) What metal was present in a watch glass?
(iii) Write the molecular formula of the salt formed after the reaction.
(iv) Write the balanced chemical equation between the metal and the acid.