# 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.<br>(i) To one portion of the solution in a test tube, add aqueous sodium hydroxide till excess.<br>(ii) To the second portion, add aqueous ammonia solution till in excess.<br>(iii) To the third portion add potassium hexacyanoferrate (II) till in excess.<br>(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.