**THE UNITED REPUBLIC OF TANZANIA**

**NATIONAL EXAMINATIONS COUNCIL OF TANZANIA**

**DIPLOMA IN SECONDARY EDUCATION EXAMINATION**

**732/2B** **CHEMISTRY 2B**

**(ACTUAL PRACTICAL 2B)**

**Time: 3 Hours** **Year: 2022**

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**Instructions**

1. This paper consists of **three (3)** questions.
2. Answer **all** questions.
3. Question number **one (1)** carries **twenty (20)** marks and the rest carry **fifteen (15)** marks each.
4. Cellular phones and any unauthorized materials are not allowed in the examination room.
5. Write your **Examination Number** on every page of your answer booklet (s)



1. Determine the amount of water of crystallization of sodium carbonate from a bottle containing anhydrous sodium carbonate which was left uncovered and labeled **T1.**

   Sodium carbonate ($Na_2CO_3$) coded **T1** with unknown concentration; solution **T2** containing 3.65 g of hydrochloric acid (HCl) in 1 $dm^3$ and **MO** methyl orange indicator. Measure 10 $cm^3$ of **T1** and dilute it with distilled water up to 150 $cm^3$ in a volumetric flask. Transfer the resulting solution into a beaker provided then pipette 20.00 $cm^3$ (or 25.00 $cm^3$) of the obtained solution and then transfer the pipetted solution into a conical flask.

Procedures:

Titrate **T2** (from the burette), against **T1** (in the titration flask) using MO until the end point. Record the results including one rough and three accurate titrations in a tabular form.

Questions:

(a) (i) What is the volume of the pipette used?

(ii) Present your results in an appropriate tabular form.

(b) Why a burette and a pipette must be rinsed with the solution which they are to be filled with?

(c) Why a titrating flask should not be rinsed with the solution which they are to be filled with?

(d) Calculate the concentration of $T_2$ in mol $dm^{-3}$ .

(e) Calculate the concentration of diluted $T_1$ in mol/$dm^3$.

(f) Determine "X" in $Na_2CO_3 \cdot XH_2O$ if the diluted 10 $cm^3$ solution contains 2.145 g of hydrated sodium carbonate.

2. Students were debating about the heat of reaction when dissolving anhydrous copper(II) sulphate and hydrated sodium thiosulphate in water. The argument was whether such reaction releases or absorbs heat. You are consulted to help to find the correct answer for their debate. In the process of undertaking the task, you are required to use the following:

   R1: Anhydrous copper (II) sulphate ($CuSO_4$);

   R2: Hydrated sodium thiosulphate ($Na_2S_2O_3.5H_2O$); Distilled water, thermometer, plastic beaker (100 $cm^3$ ), 100 $cm^3$ measuring cylinder and a stopwatch.

   Perform the experiment through the activities in the procedure and then answer the questions that follow.

Procedure

(i) Measure 50 $cm^3$ of distilled water and transfer it in the plastic beaker. Record the initial temperature in degree centigrade as T initial.

(ii) Weigh 4.0 g of R1 and transfer the salt into the measured water in (i) and immediately start a stopwatch while stirring gently the mixture with a thermometer.

(iii) Record the temperature in every 1-minute time interval five times.

(iv) Clean and dry the beaker ready for the second experiment.

(v) Repeat step (i) to (iii) except that instead of 4.0 g of R1 in step (ii), use 6.0 g of R2.

(vi) Record temperature in 1-minute time interval five times.

Questions

(a) Draw and fill the results in the appropriate table.

(b) Plot the graphs of temperature as a function of time for both $CuSO_4$ and $Na_2S_2O_3.5H_2O$ solutions in the same graph axes and show the final temperature attained for each reaction.

(c) State which salt caused exothermic or endothermic reaction among the two salts. Support your answer with a reason.

(d) Calculate the heat change for each process using the following constants: Density of water = 1 g/cm$^3$ Specific heat capacity of water (cp) = 4.2 J g$^{-1}$ ºC$^{-1}$

3. The sample salt was brought to your college as sample R. Perform a systematic qualitative analysis experiment to identify the cation and the anion present in the sample. Base your experiment on the listed tests and then answer the questions that follow:

    (i) Appearance of sample R

    (ii) Action of heat on sample R in a test tube

    (iii) Action of dilute sulphuric acid on the solid sample

    (iv) Action of concentrated sulphuric acid on solid sample

    (v) Flame test

    (vi) Solubility of the sample

    (vii) Confirmatory test for the anion

    (viii) Confirmatory test for the cation

    Questions

    (a) Prepare a relevant Table showing the analysis results.

    (b) What are the cation and anion present in the sample?

    (c) Write the reaction equation to indicate what took place in test (iv).