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

132/3A

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

Time: 3:20 Hours **Friday, 11th May 2018 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 and unauthorised materials 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, S = 32, Na = 23, K = 39, Mn = 55.
   - Molar gas constant = 8.314 J $K^{-1}mol^{-1}$.

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1. You are provided with the following solutions:
   E: 0.02 M potassium permanganate;
   F: 3.15 g hydrated oxalic acid in 500 cm^3 aqueous solution;
   G: 1 M sulphuric acid;
   Thermometer.

Theory

The reaction between potassium permanganate solution and oxalic acid is very slow and so the titration must be heated to about 80°C. In this reaction, the MnO_4^- ions act as an oxidizing agent while $C_2O_4^{2-}$ ions act as reducing agent.

Procedure

(i) Pipette 25 cm^3 or 20 cm^3 of solution **F** into a pyrex conical flask.
(ii) Add 25 cm^3 or 20 cm^3 of solution **G** in a pyrex conical flask containing solution **F**.
(iii) Heat the mixture to about 80°C.
(iv) Titrate the mixture against solution **E** until a permanent pink colour appears in the conical flask.
(v) Record the titre volume and repeat titration to obtain three readings.
(vi) Record the volume of the pipette used.

Questions

(a) Write a half reaction equation for the reduction of MnO_4^- ions to Mn^{2+} ions in acidic solution.
(b) Write a half reaction equation for the oxidation of $C_2O_4^{2-}$ to CO_2.
(c) Write an overall ionic equation to show the oxidation of $C_2O_4^{2-}$ to CO_2 by MnO_4^- ions in acidic solution.
(d) Deduce the value of water of crystallization in hydrated oxalic acid.
(e) Write the molecular formula of hydrated oxalic acid.

2. You are provided with the following:
   I: 0.4 g of magnesium ribbon;
   J: 2.0 g of magnesium carbonate;
   K: 1.0 M hydrochloric acid solution;

Procedure

(i) Measure 60 cm^3 of solution **K** into a 100 cm^3 conical flask or 100 cm^3 beaker.
(ii) Determine the initial temperature, T_1.
(iii) Add **I** in step (i) above, swirl the mixture and record the final reaction temperature reached, T_2.
(iv) Again measure out 60 cm^3 of solution **K** into a 100 cm^3 conical flask or 100cm^3 beaker.
(v) Determine the initial temperature, T_3.
(vi) Add **J** in 60 cm^3 of solution in step (iv) above, swirl the mixture and record the final temperature reached, T_4.

Questions

(a) Calculate the heat evolved during the reaction from procedure (i) to (iii) and (iv) to (vi), assume there is no change in the volume of the solution and neglect heat absorbed by the container. Given that:
Specific heat capacity of solution = 4.2 $Jg^{-1}K^{-1}$
Density of solution = 1.0 gcm^{-3}

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(b) Calculate the enthalpy of formation of magnesium carbonate ($MgCO_3$) given that, enthalpy of formation of CO_2 = - 394 $kJmol^{-1}$ and the enthalpy of formation of H_2O = - 286 $kJmol^{-1}$.

3. You are provided with sample **N** containing **one cation** and **one anion**. Carry out the experiments described in Table 3. Record carefully your observations, make appropriate inferences and finally identify the anion and cation present in sample **N**.

Table 3: Table of results

S/n	Experiment	Observations	Inference
(a)	Observe the appearance of sample **N**.		
(b)	Heat a little sample **N** in a dry test tube.		
(c)	Dissolve a little of sample **N** in water and divide the solution into four portions.		
	(i) To one portion add NaOH and warm.		
	(ii) To the second portion, add slowly freshly prepared $FeSO_4$ solution followed by conc. H_2SO_4 through the side of the test tube.		
	(iii) To the third portion, add lead ethanoate and boil.		
(e)	Perform a confirmatory test for: (i) cation (ii) anion		

Conclusion

(i) The cation in sample **N** is _____.
(ii) The anion in sample **N** is _____.
(iii) The molecular formula for sample **N** is _____.
(iv) Write a balanced chemical equation for experiment (b).

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