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 **Tuesday, 14th May 2019 a.m.**

Instructions

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

Find more free educational resources at:
http://maktaba.tetea.org
Scanned by CamScanner

1. You are provided with the following solutions:
   - **UU**: A solution made by taking 20 cm^3 of 0.5 M potassium permanganate solution and diluting it to 500 cm^3;
   - **VV**: Hydrogen peroxide solution made by diluting 13.9 cm^3 of commercial sample of hydrogen peroxide to form 500 cm^3 of aqueous solution;
   - **ZZ**: 2.0 M sulphuric acid.

Theory

The concentrations of commercial samples of hydrogen peroxide are usually expressed in volume strengths. The volume strength of hydrogen peroxide is defined as the volume of oxygen in litres at S.T.P, which would be liberated when one litre of hydrogen peroxide decomposes. The equation for such decomposition is written as: $2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$.

According to this equation, 2 moles or 68 g of hydrogen peroxide produce 22.4 dm^3 of oxygen at S.T.P. It follows that when 68 g of hydrogen peroxide are present in 1 dm^3 of hydrogen peroxide solution, the solution is 22.4 volume. Volume strengths can be converted to molarities and vice versa.

Hydrogen peroxide reacts with acidified potassium permanganate according to the following equation: $2MnO_4^-(aq) + 5H_2O_2(aq) + 6H^+(aq) \rightarrow 2Mn^{2+}(aq) + 8H_2O(l) + 5O_2(g)$.

The unknown molarity of hydrogen peroxide may be determined by standardization of acidified potassium permanganate. The aim of this experiment is to determine the volume strength of commercial hydrogen peroxide.

Procedure

(i) Pipette 20 cm^3 or 25 cm^3 of **VV** into a clean conical flask; add 20 cm^3 or 25 cm^3 of **ZZ**.
(ii) Fill the burette with **UU** and fix it to a retort stand.
(iii) Titrate this mixture (**VV** and **ZZ**) in the flask against **UU** from the burette until there is a colour change. Record the volume of **UU** used.
(iv) Repeat procedure (i) to (iii) three times and record your results in a tabular form.

Summary

The volume of pipette used was _____ cm^3.
_____cm^3 of acidified **VV** required _____ cm^3 of **UU** for complete oxidation.

Questions

(a) Write half reaction equations for oxidation of hydrogen peroxide and reduction of potassium permanganate.

(b) Calculate the molarity of solution:
   (i) **UU**
   (ii) **VV**.

(c) Using the results obtained in (b), calculate the volume strength of commercial hydrogen peroxide.

Find more free educational resources at:
http://maktaba.tetea.org
Scanned by CamScanner

2. You are provided with the following:
   - **B_1**: Solution of 1 M hydrochloric acid;
   - **B_2**: 0.2 g of magnesium ribbon;
   - **B_3**: 1 g of magnesium carbonate;
   - Thermometer.

Procedure

Case A

(i) Measure 50 cm^3 of **B_1** into a 100 cm^3 beaker or conical flask.
(ii) Determine the initial temperature T_1.
(iii) Add 0.2 g of **B_2** in (i) above. Swirl the mixture and record the final temperature T_2.

Case B

(i) Measure 50 cm^3 of **B_1** into a 100 cm^3 beaker or conical flask.
(ii) Determine the initial temperature T_3.
(iii) Add 1 g of **B_3** in (i) above. Swirl the mixture and record the final temperature T_4.

Questions

(a) Calculate the heat evolved during the reaction in case **A** and **B**, given that, the specific heat capacity of the solution = 4.2 $Jg^{-1}K^{-1}$ and density of the solution = 1 gcm^{-3}. Neglect the heat absorbed by the container and assume no change in the volume of the solution.

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

Find more free educational resources at:
http://maktaba.tetea.org
Scanned by CamScanner

3. Substance **K** contains two **cations** and two **anions**. Using the experimental information given in the Table, complete the observations and inferences and hence identify the two cations and anions.

S/n	Experiments	Observations	Inferences
1	Put a spatulaful of sample **K** into a boiling tube and add distilled water. Boil the mixture for about 1 minute. Filter or centrifuge the mixture to obtain the residue and a clear solution. Divide the resulting clear solution into two portions. (i) In the first portion, add sodium hydroxide solution till in excess. (ii) In the second portion add dil. HNO_3 followed by $AgNO_3$.		
2	To a little quantity of the residue in step 1 add hydrochloric acid.		
3	Dilute the resulting solution in step 2 with distilled water and divide the solution into two portions as follows: (i) To the first portion add dilute sodium hydroxide solution. (ii) To the second portion add dilute ammonia solution.		
4	Perform one confirmatory test for each ion.		

Conclusion

The two cations in the sample **K** are _____ and _____; the anions are _____ and _____.

Find more free educational resources at:
http://maktaba.tetea.org
Scanned by CamScanner