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)

Year : 2021

Time: 3:20 Hours

Instructions

1. This paper consists of **three (3)** questions. Answer **all** questions.
2. Question number **one (1)** carries **twenty (20)** marks and the other **two (2)** carry **fifteen (15)** marks each.
3. Qualitative Analysis Guide (QAG) sheet authorized by NECTA may be used.
4. Mathematical tables and non-programmable calculators may be used.
5. Cellular phones and any unauthorised materials are **not** allowed in the examination room.
6. Write your **Examination Number** on every page of your answer booklet(s).
7. You may use the following atomic masses:
   H = 1, C = 12, O = 16, Cl = 35.5.

1. You are provided with the following:

U1: A solution containing hydrochloric acid and acetic acid;
U2: 0.1 M sodium hydroxide solution;
POP: Phenolphthalein indicator;
MO: Methyl orange indicator.

Procedure

(i) Using a pipette filler, pipette 20 or 25 cm^3 of a solution **U1** into a conical flask.
(ii) Add two to three drops of **MO** indicator.
(iii) Titrate the solution against solution **U2** until a colour change is observed.
(iv) Record the first titre value.
(v) Add two to three drops of **POP**.
(vi) Continue to titrate until the second colour change is observed.
(vii) Record the second titre value.
(viii) Repeat the titration steps (i) to (vii) three more times and record the results as shown in Table 1.

Table 1: Table of results

Burette Reading	Pilot	1	2	3
Final readings (cm^3) using **MO**				
Final readings (cm^3) using **POP**				
Initial readings (cm^3)				
Volume used (cm^3) using **MO**				
Volume used (cm^3) using **POP**				

Summary

(i) The volume of the pipette used was _____.
(ii) _____ cm^3 of **U1** required _____ cm^3 of **U2** when **MO** was used, and _____ cm^3 of **U2** when **POP** was used.

Questions

(a) Calculate the concentration of the acid solution, **U1**, in g dm^{-3} when:
  (i) **POP** was used.
  (ii) **MO** was used.

(b) What is the colour change during titration when **MO** was used as an indicator and when **POP** was used.

(c) Name the compounds reacted during the first and second titrations

2. You are provided with the following:
A1: A solution of 0.2 M sodium thiosulphate;
A2: A solution of 0.1 M hydrochloric acid;
A3: Distilled water;
Stop watch/clock;
A sheet of white paper marked **X**.

Theory

The rate of reaction between thiosulphate and an acid is given by:

$\text{Reaction} = -\frac{d[\text{thiosulphate}]}{dt} = K[\text{thiosulphate}]^m[\text{acid}]^n$, where **K** is the rate constant and the integers **m** and **n** are orders of reaction with respect to thiosulphate and acid.

Procedure

(i) Put a 50 cm^3 beaker on top of a letter **X** on the white paper in such a way that, the mark is clearly seen through the bottom of the beaker.
(ii) Measure 2 cm^3 of **A1** and 8 cm^3 of **A3** and put them in the beaker placed on top of a sheet of white paper in procedure (i) above.
(iii) Measure 10 cm^3 of **A2** and pour in the beaker containing **A1** and **A3** and immediately start a stop watch.
(iv) Record the time taken for the precipitation to obscure the mark **X**.
(v) Repeat the experiment for different sets of volumes as shown in Table 2:

Table 2: Experimental Table

Experiment	Volume of A1 (cm^3)	Volume of A3 (cm^3) water	Volume of A2 (cm^3)	Time (sec)	1/time (s^{-1})
(a)	2	8	10		
(b)	4	6	10		
(c)	6	4	10		
(d)	8	2	10		
(e)	10	0	10		

Questions

(a) Write the ionic equation for the reaction.
(b) Calculate the value of **m**.

(c) Given that, the value of **n = 2**, find the value of **K** for experiments (a) and (b), then comment on the value of **K** obtained.

(d) From the experiment conducted, is it possible for the value of **n** to be found? Give a reason for your answer.

(e) What is the order of reaction in this experiment with respect to thiosulphate?

3. Sample **M** is a simple salt containing one cation and one anion. Carefully, carry out qualitative analysis experiment to identify the ions present in the salt based on the following tests:

(a) Appearance of the sample.
(b) Action of heat on the sample.
(c) Solubility.
(d) Action of aqueous sodium hydroxide on solution of **M**.
(e) Action of freshly prepared $FeSO_4$ solution on solution of **M** followed by concentrated H_2SO_4 through the side of the test tube.
(f) Action of lead ethanoate and then boil.
(g) Perform a confirmatory test for the cation and anion.

Questions

(i) Prepare a relevant Table showing the qualitative analysis results.
(ii) Write a balanced chemical equation for the reaction in experiment (b).