THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
DIPLOMA IN SECONDARY EDUCATTION EXAMINATION

732/2A **CHEMISTRY 2A**

(PRACTICAL A)

Time: 3 Hours **ANSWERS** **Thursday, 16th May 2019**

Instructions.

1. This paper consists of **three (3)** questions.
2. Answer **all** questions
3. Question number 1 carries 20 marks and the rest carry 30 marks.
4. Cellular phones are **note** allowed in the examination room.
5. Write your **examination Number** on every page of your answer booklet(s).

1. You are provided with the following:
   PP: A solution of 0.2 M $H_2C_2O_4 \cdot 3H_2O$ or W in 0.5 dm^3.
   QQ: A solution of unknown concentration in 1 dm^3.
   POP: Phenolphthalein indicator.

You are required to perform titrations procedure using the reagents that follow:

(a)(i) A relevant table of results to show titres from repeating burette readings.

Answer

Burette Readings	**Pilot**	**Titration 1**	**Titration 2**	**Titration 3**
Final volume (cm^3)	23.00	23.20	23.10	23.20
Initial volume (cm^3)	0.00	0.00	0.00	0.00
Volume used (cm^3)	23.00	23.20	23.10	23.20

(b)

(i) Write the half equations.

Answer

$C_2O_4^{2-}$ -----> $2CO_2 + 2e^-$
$2H^+ + 2e^-$ -----> $H_2(g)$

(ii) Specify the volume of the pipette used and calculate the mean titre volume.

Answer

Volume of pipette used: 25.0 cm^3

Mean titre = (23.20 + 23.10 + 23.20) / 3
= 69.50 / 3
= 23.17 cm^3

(c) Write a balanced chemical equation for the reaction taking place in the experiment.

Answer

$H_2C_2O_4 + 2H^+$ -----> $2CO_2 + H_2O$

(d) (i) Molarity of solution QQ.

Answer

Using $M_1V_1 = M_2V_2$
$(0.2 \times 25.0) = M_2 \times 23.17$

$M_2 = (0.2 \times 25.0) / 23.17$
$= 5.0 / 23.17$
$= 0.2157$ M

(ii) Concentration of solution QQ in g/dm³.

Answer

Molar mass of QQ (assuming it's NaOH) = 40 g/mol
Concentration = 0.2157×40
$= 8.63$ g/dm³

(iii) Molarity of solution W.

Answer

Given as 0.2 M in 0.5 dm³

(iv) The value of W in $H_2C_2O_4 \cdot W\ H_2O$.

Answer

Molar mass of $H_2C_2O_4 \cdot W\ H_2O = 90 + (18 \times W)$
Since molar mass is (126 g/mol as in prior data),
$126 = 90 + 18W$
$36 = 18W$

2. You are provided with the following:
   A solution of 0.3 M sodium thiosulphate.
   A solution of 0.1 M sulphuric acid.
   A glass stirring rod.
   White pieces of paper.
   Stop watch.

Procedure

(i) Using a blue/black pen, put a mark 'X' on a white sheet of paper and using a tripod leg/stand, put a 250 cm³ beaker on top of the mark such that mark 'X' is visible through the solution when viewed from the mouth of the beaker.

(ii) Use a measuring cylinder to measure exactly 10 cm³ of solution A and put it into the beaker on top of mark 'X'.

(iii) Use another measuring cylinder to measure 10 cm³ of solution B and pour into the beaker containing solution A and immediately start the stopwatch. Use the glass rod to stir the reaction mixture and record the time taken in seconds for the mark to disappear in triplicate.

(iv) Repeat the procedures (ii) and (iii), but this time vary the concentration of solution A by mixing with distilled water as shown in Table 1.

Table 1: Experimental data

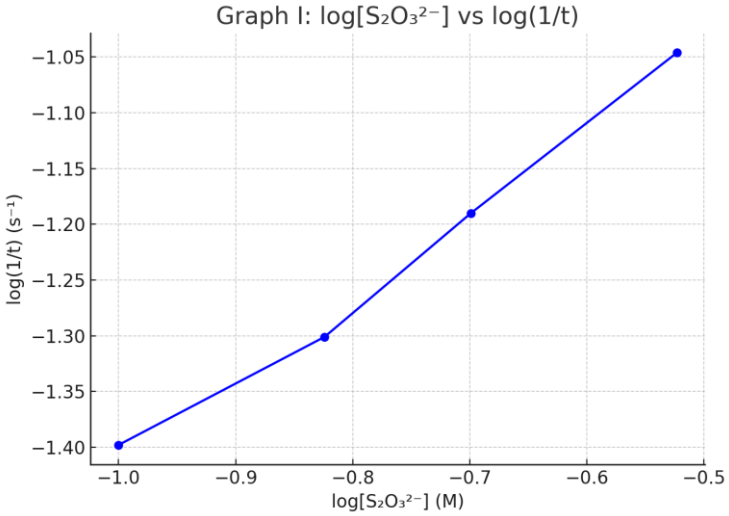
Volume of Solution A (cm^3)	Volume of distilled water (cm^3)	Volume of Solution B (cm^3)	Log$[S_2O_3^{2-}]$M	Log $[H^+]$M	Log (1/t)
10	0	10	-0.523	-1.000	-1.046
8	2	10	-0.699	-1.000	-1.190
6	4	10	-0.824	-1.000	-1.301
4	6	10	-1.000	-1.000	-1.398

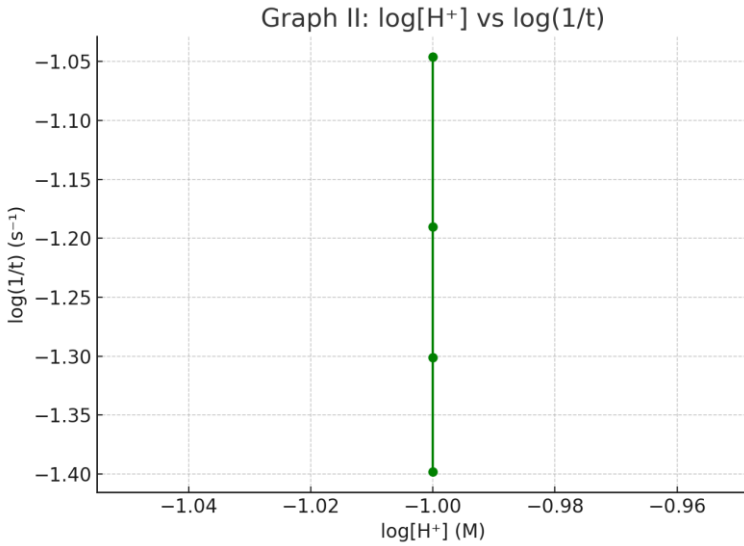
(a) Complete the table.

(b) (i) Plot graphs for:

(I) log$[S_2O_3^{2-}]$ against log(1/t)

(II) log$[H^+]$ against log(1/t)





(c) (i) Determine the order of reaction with respect to $S_2O_3^{2-}$.

Answer

From the slope of Graph (I), approximate gradient = 1, indicating first order with respect to thiosulphate.

(ii) Determine the order of reaction with respect to H^+.

Answer

As log$[H^+]$ remains constant while log(1/t) changes with $[S_2O_3^{2-}]$, no dependency is observed, so order with respect to H^+ is zero.

3. You are provided with a sample D which contains one cation and one anion.

(a) Carry out qualitative analysis experiment to identify the cation and anion present in the sample using the format and reagents provided in Table 2.

Table 2: Experimental results

S/N	Experiment	Observation	Inference
(a)	Observe the appearance of sample D.	White crystalline solid	Soluble salt
(b)	Dissolve the sample in distilled water.	Clear colourless solution	Soluble salt
(c)	Heat the solid sample in a clean and dry test tube.	No change	Stable to heat
(d)	To the solid sample in a test tube add dilute HCl.	Effervescence, gas turns limewater milky	Presence of CO_3^{2-}
(e)	To the sample solution add $BaCl_2$.	White precipitate	Presence of SO_4^{2-} or CO_3^{2-}
(f)	To the sample solution add $AgNO_3$.	No precipitate	Absence of halides
(g)	To the sample solution add dilute NH_4OH dropwise till excess.	White precipitate soluble in excess	Presence of Zn^{2+}

(b) Write the conclusion of the results indicating:

(i) Cation and anion present in sample D.

Cation: Zn^{2+}
Anion: CO_3^{2-}

(ii) Molecular formula of sample D.

$ZnCO_3$

(c) Write an equation for the reaction which took place in experiment (iii).

Answer

$ZnCO_3(s) + 2HCl(aq) \text{-----> } ZnCl_2(aq) + CO_2(g) + H_2O(l)$