THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

032/2C   **CHEMISTRY 2C**

(ACTUAL PRACTICAL C)

(For Both School and Private Candidates)

Time: 2:30 Hours   **ANSWERS**   **Year: 2013**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. You are provided with the following solutions:
FF: Containing 5.6 g of pure potassium hydroxide per 1 dm³ of solution
GG: Containing 6.0 g of impure sulphuric acid per 1 dm³ of solution
Methyl orange and phenolphthalein indicators

Questions

(a) (i) What is the suitable indicator for the titration of the given solutions? Give a reason for your answer.
Methyl orange is suitable because sulphuric acid is a strong acid and potassium hydroxide is a strong base, and methyl orange gives a sharp colour change in such titrations.

(ii) Can litmus paper be used as an indicator in this experiment? Justify your answer.
No. Litmus paper only shows whether a solution is acidic or basic, but does not provide a sharp endpoint required in titration.

(iii) Explain how you will rinse the apparatus (burette and pipette) before doing the titration.
Rinse the burette with the acid (GG) and the pipette with the base (FF) to avoid contamination or dilution that may alter concentration and accuracy.

(b) Write a balanced chemical equation for the reaction between FF and GG.
$2KOH(aq) + H_2SO_4(aq) \longrightarrow K_2SO_4(aq) + 2H_2O(l)$
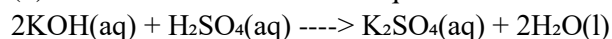
(c) Titrate the acid (in a burette) against the base (in a conical flask) using two drops of your indicator and obtain three titre values.
Assume average volume of acid used is 25.00 cm³ for 25.00 cm³ of base.

(d) (i) ___ cm³ of acid required ___ cm³ of base for complete reaction.
25.00 cm³ of acid required 25.00 cm³ of base for complete reaction.

(d) (ii) Showing your procedures clearly, determine the percentage purity of sulphuric acid.
Molar mass H_2SO_4 = 98 g/mol
Moles of base = $(5.6 \div 56)$ = 0.1 mol in 1 dm³
Volume = 25 cm³ = 0.025 dm³
Moles in 25 cm³ = 0.1×0.025 = 0.0025 mol
Mole ratio $H_2SO_4 : KOH$ = 1 : 2 → Moles H_2SO_4 = $0.0025 \div 2$ = 0.00125 mol
Mass = 0.00125×98 = 0.1225 g in 25 cm³ → in 1000 cm³ = $(0.1225 \times 1000) \div 25$ = 4.9 g
Purity = $(4.9 \div 6.0) \times 100$ = 81.7%

2. You are provided with the following materials:
SS: A solution of 0.1 M $Na_2S_2O_3$
PP: A solution of 2 M HCl
Distilled water
Stopwatch

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Prepared by: Maria Marco for TETEA

Thermometer
Paper marked X

Table 1: Completion

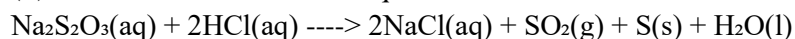| Experiment	Temperature (°C)	Time (s)
1	60	11
2	50	15
3	40	22
4	Room temp	36

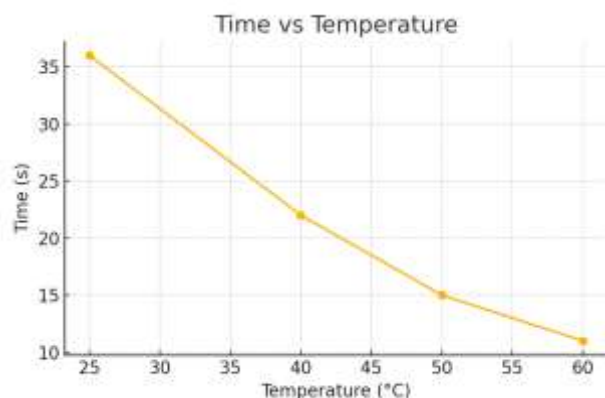Questions

(i) Complete Table 1 — done above.

(ii) Write a balanced reaction equation for reaction between SS and PP.
$Na_2S_2O_3(aq) + 2HCl(aq) \longrightarrow 2NaCl(aq) + SO_2(g) + S(s) + H_2O(l)$

(iii) Plot a graph of time against the temperature.

(iv) Why did the letter X disappear?
A precipitate of sulphur formed during the reaction, making the solution cloudy and obscuring the mark X.

(v) What conclusion can you draw from the results of this experiment?
As temperature increases, the rate of reaction increases (shorter time), indicating that temperature speeds up chemical reactions.

2. Sample Z is a simple salt containing one cation and one anion.

S/N	Experiment	Observation	Inference
a	Appearance of sample Z	White crystalline solid	Ionic compound
b	Heat sample Z in a test tube	No gas or change	Stable salt
c(i)	Add NaOH till in excess	White ppt, soluble in excess	Al^{3+} suspected
c(ii)	Add $FeSO_4$ and conc. H_2SO_4 dropwise down test tube wall	Brown ring formed	NO_3^- confirmed
c(iii)	Add ammonia solution till in excess	White ppt, soluble in excess	Confirms Al^{3+}

Conclusion
(i) The cation in sample Z is Al^{3+} and anion is NO_3^-
(ii) The name of sample Z is Aluminium nitrate
(iii) The chemical formula of sample Z is $Al(NO_3)_3$