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)

<u>**Time: 2:30 Hours**</u>   **ANSWERS**   **Year: 2012**

Instructions

1.   This paper consists of two questions.

2.   Answer all questions.

1. You are provided with the following solutions:

E: Containing 2.45 g of sulphuric acid in 500 cm³ of solution

F: Containing monovalent metal M (MOH) which was made by dissolving 2.00 g of M hydroxide in 1 litre of distilled water
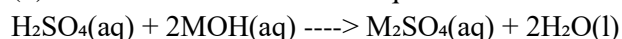
Methyl orange indicator

Questions

(a) What colour change is observed when methyl orange is added to a solution containing monovalent metal M?

The colour changes from orange to yellow indicating that the solution is basic.

(b) Write a balanced chemical equation for the reaction between E and F.

$H_2SO_4(aq) + 2MOH(aq) \longrightarrow M_2SO_4(aq) + 2H_2O(l)$

(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.

(d)

(i) _____ cm³ of acid required _____ cm³ of base for complete reaction.

Assuming 25.0 cm³ of base was used and the average titre is 20.0 cm³.

(ii) Showing your procedures clearly, identify metal M in MOH.

Molarity of H_2SO_4 = (2.45 g / 98) / 0.5 dm³ = 0.05 mol/dm³

Moles of acid in 20.0 cm³ = 0.05 × 20/1000 = 0.001 mol

From the equation, 1 mol of H_2SO_4 reacts with 2 mol of MOH

So moles of MOH = 0.001 × 2 = 0.002 mol in 25.0 cm³

Molarity of MOH = 0.002 / (25/1000) = 0.08 mol/dm³

Mass concentration = 0.08 × 40 = 3.2 g/dm³

But actual mass used = 2.00 g/dm³

So, 1 mole = 2.00 / 0.08 = 25 g/mol

The closest metal hydroxide to this molar mass is sodium hydroxide

Therefore, M is sodium, Na

(e) State any four real life applications of this practical.

- Standardizing solutions in laboratories
- Determining concentrations of unknown solutions
- Identifying unknown acids or bases
- Quality control in industries like food and pharmaceuticals

2. You are provided with the following materials:

SS: A solution of 0.270 M $Na_2S_2O_3$ (sodium thiosulphate)

PP: A solution of 2 M HCl

Distilled water; Thermometer; Stopwatch; Heat source/burner

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Procedure:
Record your results as in Table 1.

Table 1: Table of results

Exp. No.	Temperature (°C)	Time (s)	Rate (1/t) (s⁻¹)
1	Room Temperature of Solution	60	0.0167
2	40	45	0.0222
3	50	30	0.0333
4	60	20	0.0500
5	70	15	0.0667

Questions
(i) Complete Table 1.
Done above.

(ii) Write a balanced reaction equation for reaction between SS and PP.
$Na_2S_2O_3(aq) + 2HCl(aq) \longrightarrow 2NaCl(aq) + SO_2(g) + S(s) + H_2O(l)$
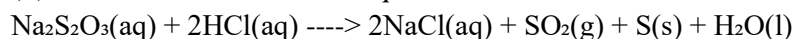
(iii) What is the product which causes the solution to cloud the letter X?
The colloidal sulphur (S) formed causes the solution to become cloudy.

(iv) Plot a graph of rate (1/t) against temperature (°C).

Rate of Reaction (1/t) vs Temperature
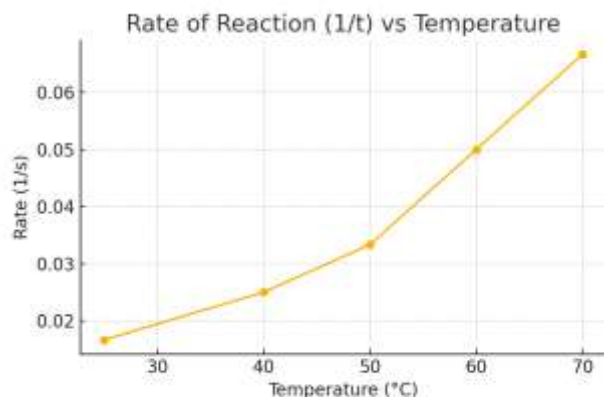
(v) What conclusion can you draw from this experiment?
As the temperature increases, the rate of reaction increases. This supports the collision theory that at higher temperature particles collide more frequently and with more energy.

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

Table 2: Table of results

S/n	Experiment	Observation	Inference
(a)	Appearance of sample Z	White crystalline solid	Salt likely to be ionic
(b)	Perform flame test on sample Z	Brick red flame observed	Presence of Ca^{2+}
(c)	To a little sample add concentrated sulphuric acid	Effervescence and colourless gas	Presence of CO_3^{2-}
(d)	Heat a little sample Z in a test tube	No change	Stable to heat
(e)	Divide solution into four portions as below		
(i)	Add NaOH dropwise in excess	White precipitate formed	Confirms Ca^{2+}
(ii)	Add aqueous ammonia dropwise and in excess	No precipitate	Confirms Ca^{2+}
(iii)	Add potassium ferrocyanide solution	White precipitate	Confirms Ca^{2+}
(iv)	Add dilute hydrochloric acid and $BaCl_2$ solution	White precipitate formed	Confirms CO_3^{2-}

Conclusion
(i) The cation in sample Z is calcium (Ca^{2+})
(ii) The anion in sample Z is carbonate (CO_3^{2-})
(iii) The formula of sample Z is $CaCO_3$
(iv) The chemical name of sample Z is calcium carbonate

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