THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

032/2A **CHEMISTRY 2A**

(ACTUAL PRACTICAL A)

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2016**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. You are provided with the following:
Q: Contains 36.5 g of HCl in 1 dm^3 solution
P: Contains 4.0 g of impure NH_4OH in 0.25 dm^3 solution

(a)
(i) If phenolphthalein were used instead of methyl orange, it would show a pink colour in basic solution and colourless in acidic solution. However, methyl orange is preferred because it changes colour sharply in strong acid-weak base titrations like HCl vs NH_4OH.
(ii) Assume average titre volume of Q = 25.0 cm^3
25.0 cm^3 of Q required 25.0 cm^3 of P
(iii) HCl is monoprotic, NH_4OH is monobasic
(iv) Colour change: Yellow to orange/pink

(b) Balanced equation:

$HCl(aq) + NH_4OH(aq) \text{----> } NH_4Cl(aq) + H_2O(l)$

(c) Calculate the percentage by weight of the impurity in the ammonium hydroxide.

Molar mass of HCl = 36.5 g/mol
Moles of HCl = 36.5 ÷ 36.5 = 1 mol in 1 dm^3
Volume used = 25 cm^3 = 0.025 dm^3
Moles used = 1 × 0.025 = 0.025 mol
NH_4OH = 0.025 mol
Mass of pure NH_4OH = 0.025 × 35 = 0.875 g
In 0.25 dm^3 of impure sample, total mass = 4.0 g
Percentage purity = (0.875 ÷ 4.0) × 100 = 21.88%
Percentage impurity = 100 – 21.88 = 78.12%

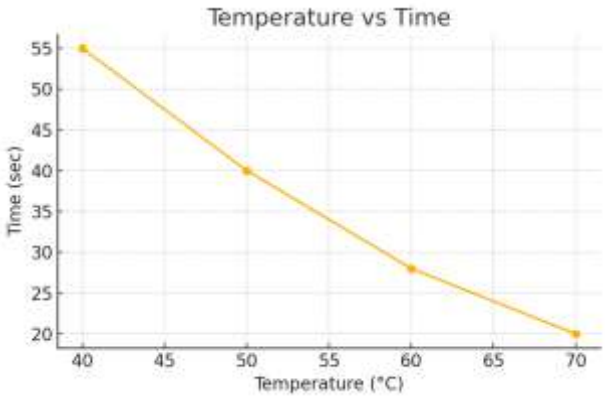
2. You are provided with:
BB: 0.25 M sodium thiosulphate
DD: 0.1 M HCl

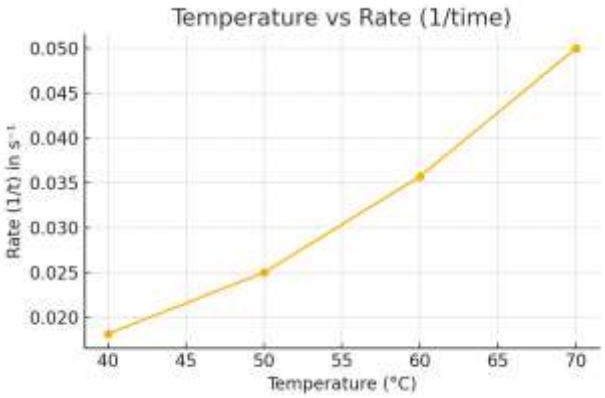
(a) Table completed:

Temperature (°C)	Time (sec)	1/time (s^{-1})
40	55	0.0182
50	40	0.0250
60	28	0.0357
70	20	0.0500

(b)(i) Room temperature ≈ 25°C, assume time = 70 sec, rate = 0.0143 s^{-1}

(ii) graphs:





(iii) The graph shows that rate increases as temperature increases.

(c) Balanced ionic equation:

$S_2O_3^{2-}(aq) + 2H^+(aq) \text{ ----> } SO_2(g) + S(s) + H_2O(l)$

(d) 1/t represents the rate of reaction.
(e) As temperature increases, the reaction rate increases due to increased kinetic energy and more frequent collisions.

3. Sample R qualitative analysis

S/N	Experiment	Observation	Inference
a	Observe sample R	Blue crystals	Presence of Cu^{2+}
b	Heat sample	Turned black	Formation of CuO
c	Add HCl	Effervescence	Presence of CO_3^{2-}
d	Add H_2SO_4	Effervescence	CO_3^{2-} confirmed
e(i)	Add NaOH	Pale blue precipitate	Cu^{2+} present
e(ii)	Add H_2SO_4 again	Effervescence	Confirms CO_3^{2-}
e(iii)	Add NH_4OH	Blue precipitate	Confirms Cu^{2+}
e(iv)	Add $FeSO_4$ then H_2SO_4	No change	Fe not present
e(v)	Add KI and cool	Brown solution formed	Confirmed Cu^{2+} with I_2

Conclusion:
(i) Cation in sample R is Cu^{2+}
(ii) Anion in sample R is CO_3^{2-}
(iii) Chemical formula of R is $CuCO_3$
(iv) Reactions:
(b) $CuCO_3(s) \text{ ----> } CuO(s) + CO_2(g)$
(c) $CuCO_3(s) + 2HCl(aq) \text{ ----> } CuCl_2(aq) + CO_2(g) + H_2O(l)$