THE UNITED REPUBLIC OF TANZANIA

NATIONAL EXAMINATIONS COUNCIL

CERTIFICATE OF SECONDARY EDUCATION EXAMINATION

032/2B **CHEMISTRY 2B**

(ACTUAL PRACTICAL B)

(For Both School and Private Candidates)

Time: 2:30 Hours **ANSWERS** **Year: 2014**

Instructions

1. This paper consists of two questions.

2. Answer all questions.

1. You are provided with the following solutions:
P: Containing 2 g of pure sodium hydroxide in 500 cm^3 of solution;
Q: Containing 5.2 g of impure sulphuric acid in 1 dm^3 of solution;
Phenolphthalein and Methyl orange indicators.

Questions

(a) Which is the suitable indicator for the titration of the given solutions? Give a reason for your answer.
Phenolphthalein is the suitable indicator because it is best used when titrating a strong base (NaOH) against a strong acid (H_2SO_4), producing a sharp endpoint with a distinct colour change from pink to colourless.

(b) 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 titre value of Q used = 24.80 cm^3 for 25.00 cm^3 of P.

(c) (i) ___ cm^3 of P required ___ cm^3 of Q for complete reaction.
25.00 cm^3 of P required 24.80 cm^3 of Q for complete reaction.

(c) (ii) With state symbols, write a balanced chemical equation for the reaction between P and Q.
$2NaOH(aq) + H_2SO_4(aq) \text{----->} Na_2SO_4(aq) + 2H_2O(l)$

(d) Showing your procedures clearly, calculate the percentage purity of sulphuric acid.
Volume of P = 25.00 cm^3 = 0.025 dm^3
Mass of NaOH = 2 g in 500 cm^3 → 4 g in 1 dm^3
Molar mass of NaOH = 40 g/mol
Moles of NaOH = 4 ÷ 40 = 0.1 mol/dm^3
Moles used = 0.1 × 0.025 = 0.0025 mol
Mole ratio NaOH : H_2SO_4 = 2:1
Moles of H_2SO_4 = 0.0025 ÷ 2 = 0.00125 mol
Volume of Q = 24.80 cm^3 = 0.0248 dm^3
Concentration = 0.00125 ÷ 0.0248 = 0.0504 mol/dm^3
Mass in 1 dm^3 = 0.0504 × 98 = 4.9392 g
Purity = (4.9392 ÷ 5.2) × 100 = 94.98%

2. You are provided with the following:
X: Containing 20 g of solid sodium thiosulphate per litre;
Y: 2.0 mol/dm^3 hydrochloric acid;
Distilled water;
Stop-watch;
Thermometer;
Plain paper

Procedure

(i) Draw a cross on a white paper.
(ii) Measure 20 cm^3 of solution X and add 20 cm^3 of distilled water in a beaker.
(iii) Heat to 60°C, then add 5 cm^3 of solution Y. Start stopwatch immediately.
(iv) Stir and observe when cross disappears.
(v) Record the time taken.
(vi) Repeat at 50°C, 40°C, and room temperature.

Questions

(a) What is the aim of this experiment?
To investigate the effect of temperature on the rate of reaction between sodium thiosulphate and hydrochloric acid.

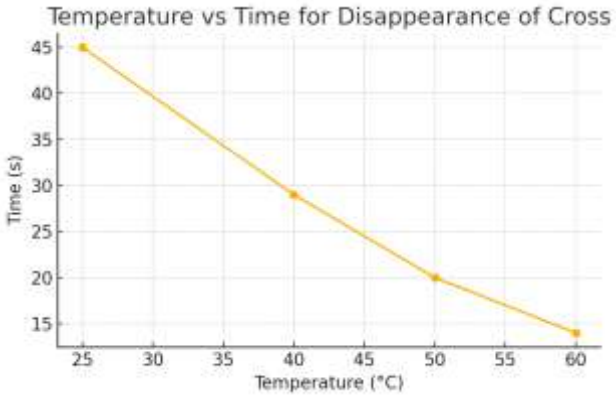
(b) Complete Table 1.

Experiment	Temperature (°C)	Concentration of sodium thiosulphate (mol/dm^3)	Time (s)
1	60	0.0635	14
2	50	0.0635	20
3	40	0.0635	29
4	Room temp	0.0635	45

(c) Giving reason(s), identify the experiment in which the reaction is:
(i) fast – Experiment 1 (highest temperature, shortest time)
(ii) slow – Experiment 4 (lowest temperature, longest time)

(d) With state symbols, write the ionic equation for the reaction between X and Y.
$S_2O_3^{2-}(aq) + 2H^+(aq) \longrightarrow SO_2(g) + S(s) + H_2O(l)$

(e) (i) Draw the graph of temperature against time.



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(e) (ii) What conclusion can you draw from the graph? Give a reason for your answer.

As temperature increases, the time for the reaction to complete decreases, meaning the rate of reaction increases. Higher temperature gives particles more energy, causing more frequent and effective collisions.

Sample J contains one cation and one anion. Using systematic qualitative analysis procedures, record carefully your observations, inferences and finally identify the anion and cation in sample J.

S/n	Experiment	Observation	Inference
a	Observe appearance	White crystalline solid	Ionic compound
b	Dissolve in water	Solution formed	Soluble salt
c	Add NaOH till excess	White ppt, soluble in excess	Al^{3+} present
d	Add dilute HCl	Effervescence observed	CO_3^{2-} present
e	Add NH_3 till excess	White ppt, soluble in excess	Confirms Al^{3+}
f	Add $AgNO_3$ then dilute HNO_3 and NH_3	White ppt, soluble in NH_3	Confirms Cl^-

Conclusion

(i) The cation present in sample J is Al^{3+}

(ii) The anion present in sample J is Cl^-

(iii) The chemical formula of sample J is $AlCl_3$

(iv) The chemical name of sample J is aluminium chloride