**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: 2012**

**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 $dm^3$ of solution
GG: Containing 6.0 g of impure sulphuric acid per 1 $dm^3$ 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.
$2KOH(aq) + H_2SO_4(aq) \text{----->} K_2SO_4(aq) + 2H_2O(l)$

(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 $cm^3$ for 25.00 $cm^3$ of base.

(d) (i) ___ $cm^3$ of acid required ___ $cm^3$ of base for complete reaction.
25.00 $cm^3$ of acid required 25.00 $cm^3$ 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 ÷ 56) = 0.1 mol in 1 $dm^3$
Volume = 25 $cm^3$ = 0.025 $dm^3$
Moles in 25 $cm^3$ = 0.1 × 0.025 = 0.0025 mol
Mole ratio $H_2SO_4$ : KOH = 1 : 2 → Moles $H_2SO_4$ = 0.0025 ÷ 2 = 0.00125 mol
Mass = 0.00125 × 98 = 0.1225 g in 25 $cm^3$ → in 1000 $cm^3$ = (0.1225 × 1000) ÷ 25 = 4.9 g
Purity = (4.9 ÷ 6.0) × 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

Thermometer
Paper marked X

Table 1: Completion

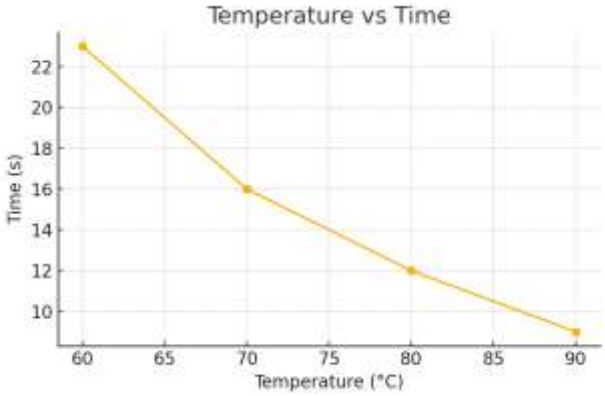
| Experiment | Temperature (°C) | Time (s) |
|---|---|---|
| 1 | 60 | 11 |
| 2 | 50 | 15 |
| 3 | 40 | 22 |
| 4 | Room temp | 36 |

Questions

(i) Complete Table 1 — done above.

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

(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.
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 $Al(NO_3)_3$

3. Substance V is a simple salt which contains one cation and one anion. Carry out the experiments described below. Record carefully your observations and make appropriate inferences and hence identify the anion and cation present in sample V.

| S/N | Experiment | Observation | Inference |
|---|---|---|---|
| 1 | Observe the appearance of sample V | White crystalline solid | Ionic salt |
| 2 | Put a little amount of sample V in a test tube then add water and shake | Dissolved completely | Soluble salt |
| 3 | Heat a little amount of V in a dry test tube | No change | Thermally stable |
| 4a | Add dilute HCl and NaOH to 1st portion | White precipitate soluble in excess | Confirms presence of $Al^{3+}$ |
| 4b | Add ammonia to 2nd portion | White precipitate soluble in excess | Confirms $Al^{3+}$ |
| 4c | Add ammonium oxalate to 3rd portion | White precipitate formed | Presence of $Ca^{2+}$ confirmed |
| 5 | Perform flame test | Brick red flame | Confirms presence of $Ca^{2+}$ |

Conclusion
(i) The cation in sample V is $Ca^{2+}$
(ii) The anion in sample V is $Cl^-$
(iii) The chemical formula of V is $CaCl_2$
(iv) The name of compound V is Calcium chloride