THE UNITED REPUBLIC OF TANZANIA
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA
DIPLOMA IN SECONDARY EDUCATION EXAMINATION

732/2B **CHEMISTRY 2B**

(ACTUAL PRACTICAL B)

Time: 3 Hours **ANSWERS** **Wednesday, 18th May 2011 a.m**

Instructions.

1. This paper consists of **three (3)** questions.
2. Answer **all** questions
3. Question number 1 carries 20 marks and the rest carry 30 marks.
4. Cellular phones are **note** allowed in the examination room.
5. Write your **examination Number** on every page of your answer booklet(s).

1. **Table 1: Titration results**

Titration No.	Trial	1	2	3
Final volume (cm^3)	22.4	44.8	67.2	89.6
Initial volume (cm^3)	0.0	22.4	44.8	67.2
Volume used (cm^3)	22.4	22.4	22.4	22.4

(a) Find the average titre value for this experiment.

Average titre = (22.4 + 22.4 + 22.4 + 22.4) / 4
= 22.4 cm^3

(b) Write a balanced chemical equation for this reaction.

$Na_2CO_3 + 2HCl$ -----> $2NaCl + CO_2 + H_2O$

(c) Why was methyl orange indicator used in this practical?

Because methyl orange is suitable for detecting the end-point of a titration between a strong acid (HCl) and a weak base (Na_2CO_3). It changes colour distinctly from yellow in alkaline medium to orange-red in acidic medium.

(d) Calculate the concentration of Na_2CO_3 in:

(i) mol/dm^3

Molar mass of Na_2CO_3 = 106 g/mol

Mass in 250 cm^3 = 2.7 g

Moles = 2.7 / 106
= 0.02547 mol

Molarity = 0.02547 mol / 0.250 dm^3
= 0.1019 mol/dm^3

(ii) g/dm^3

Concentration = 0.1019 × 106
= 10.8 g/dm^3

(e) Determine the value of W in the formula $Na_2CO_3 \cdot W\ H_2O$

Given 2.7 g of hydrated salt in 250 cm^3
But pure Na_2CO_3 molarity = 0.1019 mol/dm^3

Mass of $Na_2CO_3 \cdot W\ H_2O$ in 1 dm^3 = 2.7 × 4
= 10.8 g

Molar mass of hydrated salt = 10.8 / 0.1019
= 106 × (W factor)

106 + 18W = (10.8 / 0.1019)
= 106 + 18W = 106

Which means W = 0

Therefore, no water of crystallisation — the salt is anhydrous (Na_2CO_3)

(f) State three uses of this titration

1. Determining the concentration of hydrochloric acid.
2. Standardising acid solutions in laboratories.
3. Quality control in industries producing soft drinks and detergents.

2. Table 2: Experimental results

Temperature	T(K)	Time (s)	(K^{-1})	(s^{-1})
50°C	323	60	0.00310	0.0167
60°C	333	40	0.00300	0.0250
70°C	343	25	0.00292	0.0400
80°C	353	17	0.00283	0.0588

(a) Write the ionic equation for the formation of the cloud in the solution

$S_2O_3^{2-} + 2H^+$ -----> $SO_2 + S$ (precipitate) + H_2O

(b) Plot a graph of log(1/t) against 1/T and find the slope

We can compute log(1/t):

T(K)	1/T (K^{-1})	1/t (s^{-1})	log(1/t)
323	0.00310	0.0167	-1.78
333	0.00300	0.0250	-1.60
343	0.00292	0.0400	-1.40
353	0.00283	0.0588	-1.23

Plot these points, draw the best fit line.

Slope = Δ(log 1/t) / Δ(1/T)

Pick two points:
(-1.78, 0.00310) and (-1.23, 0.00283)

Slope = (-1.23 - (-1.78)) / (0.00283 - 0.00310)
= (0.55) / (-0.00027)
= -2037

(c) Use the relation slope = -Ea / 2.303R to determine activation energy

R = 8.314 J/mol·K

Ea = - (slope × 2.303 × R)
= - (-2037 × 2.303 × 8.314)
= 38998 J/mol
= 39.0 kJ/mol

3. Systematic Qualitative Analysis of Sample Q

Test	Observation	Inference
Appearance	White crystalline solid	Possible chloride or carbonate
Flame test	Bright yellow flame	Sodium ion (Na^+) present
Solubility	Soluble in water	Ionic salt
Action with dilute HNO_3	Effervescence, gas turns lime water milky	CO_3^{2-} present
Action with $AgNO_3$ solution	White precipitate	Cl^- present

Conclusion

Cation: Na^+
Anion: Cl^-

Formula of salt: NaCl

Name: Sodium chloride