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

732/2A **CHEMISTRY 2A**

(ACTUAL PRACTICAL A)

Time: 3 Hours **ANSWERS** **Thursday, 15th May 2014 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. (a) Perform a titration experiment using the following requirements:

Procedure Summary:

- DD in burette
- Pipette 25 cm^3 PP into flask
- Add 2 drops MO
- Titrate DD against PP until colour change, repeat 3 times

Questions

(i) Find the volume of acid required to neutralize SC solution.

Answer

Titration	Final burette reading (cm^3)	Initial burette reading (cm^3)	Volume used (cm^3)
1	21.30	0.00	21.30
2	21.40	0.00	21.40
3	21.20	0.00	21.20

Average titre = (21.30 + 21.40 + 21.20) / 3 = 21.30 cm^3

(ii) Write balanced molecular and ionic equations for the reaction.

Answer

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

Ionic:
$CO_3^{2-} + 2H^+$ -----> $CO_2 + H_2O$

(iii) What colour change was observed at the end-point?

Answer
Yellow to orange

(iv) Why was the indicator necessary in this titration?

Answer
To signal the completion of the neutralisation by changing colour at the end point.

(v) What do you think was the reason for using Methyl Orange instead of POP?

Answer
Because Methyl Orange is suitable for strong acid–weak base titrations while phenolphthalein would give an inaccurate end point in such reactions.

(b) From the titration you performed, calculate:

(i) Molarity of DD.

Answer

Using $M_1V_1 = M_2V_2$

$M_2 = (0.2 \times 25) / 21.30$
$= 5 / 21.30$
$= 0.2347$ M

(ii) Molarity of SC.

Answer

Same as PP: 0.2 M

(iii) Mass of sodium carbonate present in dm^3 of impure sample.

Answer

Molar mass Na_2CO_3 = 106 g/mol
Mass = 0.2 × 106 = 21.2 g

(c) Suppose impurities contained in SC is water of crystallisation in the formula $Na_2CO_3.7H_2O$:

(i) Calculate the value of T.

Molar mass Na_2CO_3 = 106 g
Molar mass $Na_2CO_3.7H_2O$ = 106 + (7×18) = 232 g
% purity = (106 / 232) × 100 = 45.69%

2. (a) Tabulate your results as follows

Exp. No.	**Vol. of $Na_2S_2O_3$ (cm^3)**	**Time (s)**	**1/t (s^{-1})**
1	4	120	0.00833
2	8	60	0.01667
3	12	40	0.02500

(b) Assuming volumes are directly proportional to concentrations:

(i) Write a balanced ionic equation for the reaction.

Answer

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

(ii) Find the value of x (from a graph of log(rate) against log[$Na_2S_2O_3$])

Answer

From doubling concentration:
(0.00833 to 0.01667) when [$S_2O_3^{2-}$] doubles, rate doubles
Therefore, x = 1

(iii) Given x = 1, find k (using first result)

Rate = k [$S_2O_3^{2-}$]

0.00833 = k × (4/24)
= k × 0.1667
k = 0.00833 / 0.1667
k = 0.04998 s^{-1}

(iv) State the order of reaction for this experiment.

Answer

First order with respect to $Na_2S_2O_3$

(c) (i) Giving one reason explain how the rate of reaction would be affected if:

(i) Temperature increased

Answer
Rate would increase as higher temperature increases particle kinetic energy, leading to more effective collisions.

(ii) The value of k would be less than the one found in this experiment.

Answer
Because rate constant (k) depends on temperature; lower temperature reduces k.

3. (a) Data Table

Test	**Observation**	**Inference**
(i) Appearance	White crystalline solid	Possible halide/carbonate
(ii) Solubility	Soluble in water	Ionic salt
(iii) Flame test	Yellow flame	Sodium cation present
(iv) Dilute HCl	Effervescence (CO_2 gas)	Presence of CO_3^{2-}
(v) Barium nitrate	White precipitate	SO_4^{2-} or CO_3^{2-}
(vi) Silver nitrate	No precipitate	No Cl^-, Br^-, I^-
(vii) NaOH	White ppt soluble in excess	Amphoteric or zinc/lead

(viii) NH_4OH	White ppt soluble in excess	Zinc confirmed

(b) (i) Write your summary based on the cation and anion present in sample F.

Answer
Cation: Zinc (Zn^{2+})
Anion: Carbonate (CO_3^{2-})

(ii) Molecular formula for sample F.

Answer
$ZnCO_3$

(iii) Name the compound.

Answer
Zinc carbonate

(c) (i) Molecular and ionic equation for reaction in test (viii)

Answer

$Zn^{2+} + 2OH^- \text{-----> } Zn(OH)_2$ (white ppt)

(ii) Ionic equation for reaction in test (vi)

Answer

$CO_3^{2-} + 2Ag^+ \text{-----> No reaction (since no halide)}$

(iii) Name of the compound formed in test (viii)

Answer
Zinc hydroxide