FORM 4 EVALUATION TEST 2021
CHEMISTRY PAPER 3

You are provided with
- Anhydrous sodium carbonate solid x.
- Distilled water.
- 0.2m Hydrochloric acid solution A.

You are required to determine molar heat of solution of solid x.

PROCEDURE I

i. Place 50.0ml of water in 250ml plastic beaker.
ii. Note the temperature of the water and record it in the table I below.
iii. Add all the solid X provided to the water in the beaker, stir gently with the thermometer and record the final temperature of the solution in the table I below. Keep the resulting solution for procedure 2.

TABLE I

Final temperature (^0C)	
Initial temperature (^0C)	
Change in temperature (^0C)	

(2 mks)

(a) What is the enthalpy change for the reaction? (Assume the density of solution is 1g/cm^3, and specific heat capacity is 4.2 Jg^{-1} K^{-1}). (2 mks)

PROCEDURE II

Transfer the contents of the beaker into 250ml volumetric flask. Rinse both the beaker and the thermometer with distilled water and ass this water into the solution in the volumetric flask. Add more water to make up to the mark. Label this solution as solution X. fill the burette with solution A. Using a pipette place 25.0ml of solution X into a conical flask. Add 3 drops of methyl orange indicator and titrate with solution A. record your readings in table II below. Repeat the titration two more times and complete the table.

TABLE II

Experiment			
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution A used (cm^3)			

(3 mks)

(b) Calculate average volume of solution A used. (1 mk)

(c) the number of moles of solution A used. (1 mk)

(d) The number of moles of solution X that reacted with the number of moles of solution A in (c) above. (1 mk)

(e) The number of moles of solid X used in procedure I. (1 mk)

(f) Molar heat of solution of anhydrous sodium carbonate. (2 mks)

2. You are provided with:
- A solution of sodium hydroxide labeled B.
- A solution of sulphuric(vi)acid labeled C.

You are required to determine the concentration of the alkali using the following procedure.

PROCEDURE:
(i) Place $40cm^3$ of sodium hydroxide solution into a 250 ml plastic beaker.
(ii) Measure $60cm^3$ of sulphuric (vi) acid solution.
(iii) Determine the temperature of sodium hydroxide solution at half a minute intervals for two minutes and record it in the table below.
(iv) At 2 ½ minutes, place the $60cm^3$ of solution C into the plastic beaker while stirring and resume taking the temperature in the 3rd minute.

(v) Complete the table below.

Time in minutes	0	½	1	1 ½	2	2 ½	3	3 ½	4

Temperature in ^0C									

Time in minutes	4 ½	5	5 ½	6	6 ½	7
Temperature in ^0C						

(3 mks)

(a) Plot a graph of temperature against time. (3 mks)

(b) From the graph, determine the highest temperature change. (1 mk)

(c) Determine the heat evolved in this experiment (Density of solution = 1 g/cm^3 specific heat capacity of solution = 4.2 $Jg^{-1}\ K^{-1}$) (2 mks)

(d) Given that the molar heat of neutralization is 56KJ/mole, determine the number of moles of sodium hydroxide used in the neutralization reaction above. (2 mks)

(e) Determine the molarity of sodium hydroxide. (2 mks)

3. You are provided with solid K. carry out the following tests and write your observations and inferences in the spaces provided.

	TEST	**OBSERVATION**	**INFERENCE**
(a)	Place a spatula full of sample K in a clean dry test tube. Heat gently and then strongly.	(1 mk)	(1 mk)
(b)	Put the remaining solid K in a boiling tube. Add about $8cm^3$ of distilled water. Shake well and divide the solution into 3 portions.		
(i)	To the first portion add 3 drops of sodium hydroxide solution and then excess.	(1 mk)	(1 mk)
(ii)	To the second portion add 3 drops of ammonia solution and then excess.	(1 mk)	(1 mk)

(iii)	To the third portion add 3 drops of Barium nitrate followed by 3 drops of nitric acid.	(1 mk)	(1 mk)
(c)	You are provided with solid P. carry out the tests below and record your observations and inferences.		
(i)	Place half spatula of solid P in a non-luminous flame of a Bunsen burner.	(1 mk)	(1 mk)
(ii)	Dissolve the remaining solid in water and divide into two portions		
(a)	Add 3 drops of universal indicator to the 1^{st} portion and determine the PH of the solution.	(1 mk)	(1 mk)
(b)	To the 2^{nd} portion add a little sodium hydrogen carbonate		

		(1 mk)	(1 mk)