3.7.3 Chemistry Paper 3 (233/3)

- 1. You are provided with:
 - 5.3 g solid A, sodium carbonate;
 - · Solution B, hydrochloric acid.

You are required to determine the:

- Molar heat of the solution of solid A;
- Concentration of the hydrochloric acid, solution B.

PROCEDURE I

Using a burette, place 30.0 cm³ of distilled water in a 100 ml plastic beaker. Stir the water with a thermometer and measure its temperature after every half-minute interval. Record the readings in **Table 1**.

At exactly 2 minutes, add all of solid A to the water at once. Stir well and continue measuring the temperature of the mixture after every half-minute interval. Record the readings in Table 1. Retain the mixture in the beaker for use in Procedure II.

(a) Table 1

Time (minutes)	0	1/2	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
Temperature (°C)			-	-m 3	X	lon to	V.	mula.		100	

(3 marks)

(b) On the grid provided, plot a graph of temperature (vertical axis) against time.

(3 marks)

(c) Determine from the graph, the temperature change, ΔT.

(1 mark)

(d) Calculate the:

(i) number of moles of solid A used. (RFM = 106)

(1 mark)

(ii) molar enthalpy of solution, ΔH_{soln} and show the sign of ΔH_{soln} . (Assume that for the solution, density = 1.0 gcm⁻³ and specific heat capacity = 4.2 Jg⁻¹K⁻¹) (2 marks)

PROCEDURE II

- (i) Fill a burette with solution B.
- (ii) Transfer all of the mixture in the 100 ml plastic beaker from procedure I into a 250 ml volumetric flask. Add distilled water to make up to the mark and shake. Label the mixture as solution A.
- (iii) Using a pipette and pipette filler, place 25.0 cm³ of solution A into a 250 ml conical flask. Add two or three drops of phenolphthalein indicator and titrate with solution B. Do not pour out the contents of the conical flask.

Record the readings in Table 2

Add two or three drops of methyl orange indicator to the contents of the conical flask. Titrate the mixture with **solution B** and record the readings of this second titration in **Table 3**.

Repeat Procedure II, step (iii) and complete Tables 2 and 3.

(e) (i) Table 2, using phenolphthalein indicator.

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Final burette reading	lat years what	unxim sdr lo sig
Initial burette reading		d sel al seulain
Volume of solution B used, cm ³	ing in our opinions	and the lighter ha

(3 marks)

(ii) Table 3, using methyl orange indicator.

superature (vertical axis) against time	To dry a tolo	II
Final burette reading		
Initial burette reading	rept, the tempor	e edi utari snim
Volume of solution B used, cm ³		

(3 marks)

Average volume, V_2 , of solution B used = $(\frac{1}{2} \text{ mark})$

(f) Calculate the:

- (i) concentration, in moles per litre, of sodium carbonate in **solution A**. (1 mark) RFM = 106
- (ii) number of moles of sodium carbonate in 25.0 cm³ of solution A. (1 mark)
- (iii) number of moles of hydrochloric acid in the total volume, $V_1 + V_2$, of solution B. (1 mark)
- (iv) concentration, in moles per litre, of hydrochloric acid in solution B. (1 mark)

2.	You are provided with solid C. Carry out the following tests. Write the observations and inferences in the spaces provided.
	Place all of solid C in a boiling tube. Add about 20 cm ³ of distilled water and shake until all of the solid dissolves. Label the solution as solution C. Use about 2 cm ³ of solution C in a test tube for each of the following tests.

(a) Add aqueous sodium hydroxide dropwise until in excess.

Observations	Inferences
(i muk)	(Umark)
and said it. Carp, out the following tests	You are provided with an organic commo
provided	(a) Describe the appearance of solid
(1 mark)	(2 marks)

(b) Add three drops of aqueous sodium sulphate.

Observations	Inferences	
n days it much ban scale dance it is (1 mark)	(i) Place the first persons of sout in co	
Inferences	Observations	
(1 mark)	(1 mark)	

(c) Add three drops of aqueous barium nitrate.

Observations	Inferences	
(chara 1)	(sham 1)	
Faild D is a test tube. Add about 3 cm ² of a	(ii) Place the second portion o	
(1 mark)	(2 marks)	

	Billin	Observations	Inferences				
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	Rocco	(1 mark)	(1 mark)	The state of			
		vided with an organic compound, solid D s and inferences in the spaces provided.	. Carry out the following tests. R	ecord the			
(a)	Desc	ribe the appearance of solid D.		(1 mark			
		(elum 5)	(Aug I)				
		eyaneld	malla result				
(b)	Divide solid D into four portions.						
	(i)	Place the first portion of solid D on a war burner flame.	vatch glass and burn it with a Bu	nsen			
		Observations	Inferences	(min			
		Hitti A policy methyl comprehedulists	(shum 1)				
		- ajanin mu	Add three dipps of adjectin int	(a)			
		e negative reg	Observations				
		(1 mark)	(1 mark)				
	(ii)	Place the second portion of solid D in a sodium hydroxide and shake.	a test tube. Add about 3 cm ³ of ac	lueous			
		Observations	Inferences	d mark			
		the second section is made, on face, of our	in a column in this in A	() mush			
		tonomies, in male, per fam, of an EFM = 100	in orbital in selection A.	()-medi			

(iii) Place the third portion of **solid D** in a test tube. Add about 3 cm³ of distilled water. Heat the mixture and add **three** drops of acidified potassium manganate(VII).

Observations	Inferences
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amonușto 1	(a) Name the causaine level of
(1 mark)	

(1 mark) (1 mark)

(iv) Place the fourth portion of solid D in a test tube. Add about 3 cm³ of distilled water. Heat the mixture and add all the solid sodium hydrogen carbonate provided.

Observations	Inferences
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	Control with the classic states of the Control

(1 mark) (1 mark)

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