



TEST CODE **02212032**

MAY/JUNE 2010

FORM TP 2010153

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

A D V A N C E D P R O F I C I E N C Y E X A M I N A T I O N

C H E M I S T R Y

U N I T 0 2 – P a p e r 0 3 / 2

A L T E R N A T I V E T O I N T E R N A L A S S E S S M E N T E X A M I N A T I O N

2 hours

**You are advised to use the first 10 minutes
for reading through this paper carefully.**

READ THE FOLLOWING DIRECTIONS CAREFULLY.

- 1. Answer ALL questions on this paper.**
- 2. Use this answer booklet when responding to the questions. For EACH question, write your answer in the space indicated and return the answer booklet at the end of the examination.**
- 3. The use of silent, non-programmable calculators is allowed.**
- 4. A data booklet is provided.**

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1. (a) You have been provided with five samples – three alcohols (A, B and C) and two carbonyl compounds (D and E). Carry out the following tests, being careful to add reagents gradually until no further change is observed, and shaking gently after each addition. Record your observations in Table 1 and Table 2 where relevant. Your recordings should include details of colour changes and precipitates formed.

TABLE 1: TESTS ON ALCOHOLS A, B AND C

Test	Observations		
	A	B	C
Carry out the following tests on approximately 2 cm ³ of each alcohol.			
(i) Add K ₂ CrO ₇ (aq) followed by a few drops of dilute H ₂ SO ₄ and warm gently.			
(ii) Add approximately 2 cm ³ of NaOH(aq) followed by I ₂ dropwise, until I ₂ is no longer decolourized. Warm gently.			

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TABLE 2. TESTS ON CARBONYL COMPOUNDS D AND E

Test	Observations	
	D	E
Carry out the following tests on approximately 2 cm ³ of each carbonyl compound.		
(i) Add approximately 2 cm ³ of NaOH followed by I ₂ dropwise, until I ₂ is no longer decolourized.		
(ii) Add a few drops of 2, 4 – DNPH.		
(iii) To approximately 2 cm ³ of AgNO ₃ add a few drops of NaOH(aq) followed by NH ₃ (aq) until the precipitate dissolves. Add the carbonyl compound and warm the mixture.		

[12 marks]

- (b) Alcohols A, B and C may be 1-butanol, 2-methyl -2 - propanol or 2-butanol. Based on your observations in Table 1, identify EACH alcohol, A, B and C.

Sample	Alcohol
A	_____
B	_____
C	_____

[3 marks]

- (c) (i) Based on your observations in Table 2, identify the class of carbonyl compounds in the samples, D and E.

Sample	Carbonyl Compound
D	_____
E	_____

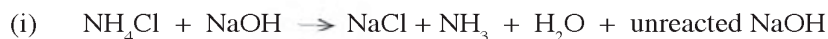
[2 marks]

- (ii) Give a reason for your answer in (c) (i) above.

[1 mark]

Total 18 marks

2. A student was required to determine the solubility of ammonium chloride using a back titration technique described by the following equations:



The procedure followed by the student is as follows:

- (i) Pipette 5.0 cm³ of saturated NH₄Cl solution into a 250.0 cm³ volumetric flask and make up to the mark with distilled water. Label this solution A.
- (ii) Pipette 20.0 cm³ portions of Solution A into each of three 250 cm³ conical flasks, adding 20 cm³ of 0.200 mol dm⁻³ NaOH solution to each flask.
- (iii) Heat the contents of each conical flask to boiling to remove all traces of ammonia.
- (iv) Cool the flasks and contents, and titrate each against 0.100 mol dm⁻³ HCl solution using an appropriate indicator.

N.B.: For each titration the initial titre volume was taken as 0.50 cm³.

Burette readings of the titre (volume) for each experiment are given in Figure 1.

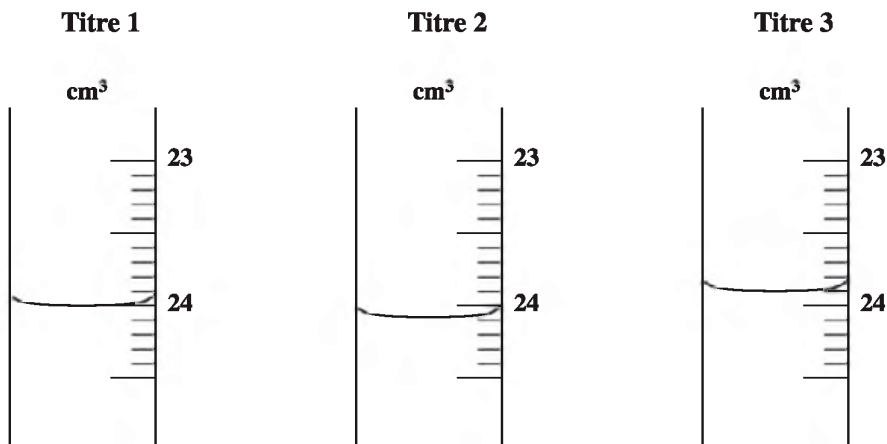


Figure 1. Burette readings for each experiment

- (a) Using the readings in Figure 1, record the titre volumes of the experiments in Table 3.

TABLE 3: VOLUME OF TITRE

	Expt 1	Expt 2	Expt 3	
Final volume of HCl (cm ³)				
Initial volume of HCl (cm ³)	0.50	0.50	0.50	Avg. Volume
Volume of HCl used (cm ³)				

[4 marks]

- (b) Calculate the number of moles of sodium hydroxide present in 20.0 cm³ of NaOH solution.

[2 marks]

- (c) Calculate the number of moles of HCl used in the titration.

[2 marks]

- (d) Determine the number of moles of NaOH which remained after boiling with NH₄Cl solution.

[1 mark]

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- (e) Determine the number of moles of NH_4Cl present in 20.0 cm^3 of Solution A.

[2 marks]

- (f) Calculate the number of moles of NH_4Cl present in 5.0 cm^3 of the saturated solution.

[2 marks]

- (g) Calculate the solubility of NH_4Cl in water at room temperature in mol dm^{-3} and g dm^{-3} of solution.

Solubility of NH_4Cl in mol dm^{-3} :

Solubility of NH_4Cl in g dm^{-3} :

[3 marks]

- (h) Suggest ONE way the student could determine that all the ammonia had been boiled off in Step (iii) of the experimental procedure (page 5).

[1 mark]

- (i) Suggest a suitable indicator for the titration carried out in Step (iv) of the experimental procedure (page 5).

[1 mark]

Total 18 marks

3. You are told by your neighbour that the drinking water in the community contains traces of lead due to the lead pipes used in the community water system.

Use the following guidelines to plan and design an experiment to establish the truth of your neighbour's claim.

- (i) Hypothesis:

[1 mark]

- (ii) Reagents and equipment:

[3 marks]

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(iii) Procedure:

[3 marks]

(iv) Variables

Controlled:

Manipulating:

Responding:

[3 marks]

(v) One precaution to be taken:

[1 mark]

(vi) Expected results:

[1 mark]

Total 12 marks

END OF TEST