



TEST CODE **02212032**

**FORM TP 2012157**

MAY/JUNE 2012

**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   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*

**READ THE FOLLOWING INSTRUCTIONS 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 non-programmable calculators is allowed.
4. A data booklet is provided.

**DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.**

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**Answer ALL questions.**

1. A is a solution containing barium ions.  
B is a solution of sodium carbonate containing 0.1 moles in 1 dm<sup>3</sup>.  
C is a solution containing 0.1 moles of hydrochloric acid in 1 dm<sup>3</sup> of solution.

You are required to determine the concentration of barium ions in A.

- (a) Procedure
- (i) Pipette 25 cm<sup>3</sup> of A into the beaker provided and boil gently.
  - (ii) Using a pipette, add 50 cm<sup>3</sup> of B to the beaker.
  - (iii) Stir the contents of the beaker and filter into a conical flask wash the beaker and precipitate with water several times and collect the washings with the filtrate in the flask
  - (iv) Titrate the total filtrate with C in the burette, using the indicator provided.
  - (v) In Table 1, record **to two decimal places**, both your initial burette reading and the reading at the end point.
  - (vi) Repeat steps (ii) - (v).

**TABLE 1: BURETTE READINGS**

	Burette Readings	
	1	2
Final Volume (cm <sup>3</sup> )		
Initial Volume (cm <sup>3</sup> )		
Volume of HCl used (cm <sup>3</sup> )		

[ 5 marks]

- (b) Determine the volume of HCl to be used in your calculations.
- (c) Calculate the number of moles of Na<sub>2</sub>CO<sub>3</sub> in 50 cm<sup>3</sup> of B.

[ 1 mark ]

[ 1 mark ]

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- (d) Write an equation for the reaction of sodium carbonate and hydrochloric acid.

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[ 2 marks ]

- (e) Calculate the number of moles of hydrochloric acid used to neutralise the excess sodium carbonate.

[ 1 mark ]

- (f) Calculate the number of moles of excess sodium carbonate used.

[ 1 mark ]

- (g) Deduce the number of moles of sodium carbonate used to precipitate the barium ions in A.

[ 1 mark ]

- (h) Write an equation for the precipitation of barium ions by sodium carbonate.

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[ 2 marks ]

- (i) Deduce the number of moles of barium ions in 25 cm<sup>3</sup> of A.

[ 1 mark ]

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- (j) Calculate the concentration, in moles per  $\text{dm}^3$ , of barium ions in A.

[ 1 mark ]

- (k) State a reason why the concentration of barium ions in A could not be determined by direct titration with hydrochloric acid.

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[ 1 mark ]

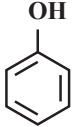
**Total 17 marks**

2. Complete Table 2, using simple, common test-tube reactions, with the associated observations to distinguish between EACH pair of Compounds P and Q. Suggest (by drawing the structure) ONE other compound, with **no more than four carbon atoms**, which would also give a positive result with the test you have chosen. The first one (a) is done for you.

**TABLE 2: DISTINGUISHING BETWEEN COMPOUNDS A AND B**

Compounds	Test	Observation	Suggested Compound
(a) $\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{OH} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$ <p style="text-align: center;">P</p> $\begin{array}{c} \text{H} \quad \text{O} \\   \quad    \\ \text{H}-\text{C}-\text{C}-\text{OH} \\   \\ \text{H} \end{array}$ <p style="text-align: center;">Q</p>	(i) Add $\text{NaHCO}_3$ to both P and Q	(ii) No reaction with P; effervescence occurs with Q.	(iii) $\begin{array}{c} \text{H} \quad \text{H} \quad \text{O} \\   \quad   \quad    \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{OH} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$
(b) $\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \quad   \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$ <p style="text-align: center;">P</p> $\begin{array}{c} \quad \quad \quad \text{H} \\ \quad \quad \quad   \\ \text{H}-\text{C}=\text{C}-\text{C}-\text{H} \\   \quad   \quad   \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$ <p style="text-align: center;">Q</p>	(i)	(ii)	(iii)
	<b>1 mark</b>	<b>1 mark</b>	<b>1 mark</b>
(c) $\begin{array}{c} \text{H} \quad \text{H} \quad \text{O} \\   \quad   \quad    \\ \text{H}-\text{C}-\text{C}-\text{C} \backslash \text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$ <p style="text-align: center;">P</p> $\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \quad   \\ \text{H} \quad \text{H} \quad \text{OH} \end{array}$ <p style="text-align: center;">Q</p>	(i)	(ii)	(iii)
	<b>1 mark</b>	<b>1 mark</b>	<b>1 mark</b>
(d) $\begin{array}{c} \text{H} \quad \text{H} \quad \text{O} \\   \quad   \quad    \\ \text{H}-\text{C}-\text{C}-\text{C} \backslash \text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$ <p style="text-align: center;">P</p> $\begin{array}{c} \text{H} \quad \text{O} \quad \text{H} \\   \quad    \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad \quad   \\ \text{H} \quad \quad \text{H} \end{array}$ <p style="text-align: center;">Q</p>	(i)	(ii)	(iii)
	<b>1 mark</b>	<b>1 mark</b>	<b>1 mark</b>

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Compounds	Test	Observation	Suggested compound
<p>(e)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <math display="block">  \begin{array}{cccc}  \text{H} &amp; \text{H} &amp; \text{H} &amp; \text{H} \\    &amp;   &amp;   &amp;   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{C}-\text{H} \\    &amp;   &amp;   &amp;   \\  \text{H} &amp; \text{H} &amp; \text{H} &amp; \text{OH}  \end{array}  </math> <p>P</p> </div> <div style="text-align: center;"> <math display="block">  \begin{array}{c}  \text{H} \\    \\  \text{H}-\text{C}-\text{H} \\    \\  \text{H} \quad \text{H} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    \quad   \quad   \\  \text{H} \quad \text{OH} \quad \text{H}  \end{array}  </math> <p>Q</p> </div> </div>	<p>(i)</p> <p style="text-align: center;"><b>1 mark</b></p>	<p>(ii)</p> <p style="text-align: center;"><b>1 mark</b></p>	<p>(iii)</p> <p style="text-align: center;"><b>1 mark</b></p>
<p>(f)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <math display="block">  \begin{array}{cc}  \text{H} &amp; \text{H} \\    &amp;   \\  \text{H}-\text{C}-\text{C}-\text{H} \\    &amp;   \\  \text{H} &amp; \text{OH}  \end{array}  </math> <p>P</p> </div> <div style="text-align: center;"> <math display="block">  \begin{array}{ccc}  \text{H} &amp; \text{H} &amp; \text{H} \\    &amp;   &amp;   \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\    &amp;   &amp;   \\  \text{H} &amp; \text{H} &amp; \text{OH}  \end{array}  </math> <p>Q</p> </div> </div>	<p>(i)</p> <p style="text-align: center;"><b>1 mark</b></p>	<p>(ii)</p> <p style="text-align: center;"><b>1 mark</b></p>	<p>(iii)</p> <p style="text-align: center;"><b>1 mark</b></p>
<p>(g)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>P</p> </div> <div style="text-align: center;"> <math display="block">  \begin{array}{ccc}  \text{H} &amp; \text{H} &amp; \text{O} \\    &amp;   &amp;    \\  \text{H}-\text{C}-\text{C}-\text{C}-\text{OH} \\    &amp;   &amp; \\  \text{H} &amp; \text{H} &amp;   \end{array}  </math> <p>Q</p> </div> </div>	<p>(i)</p> <p style="text-align: center;"><b>1 mark</b></p>	<p>(ii)</p> <p style="text-align: center;"><b>1 mark</b></p>	

**Total 17 marks**

3. A student has been advised to include an iron supplement in her diet to combat possible deficiency. Two brands of the supplement in tablet form have been identified

Plan and design an experiment to allow the student to decide which is the better brand based on the amount of available iron.

- (a) Hypothesis:

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**[ 1 mark ]**

- (b) Aim:

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**[ 1 mark ]**

- (c) Apparatus and materials:

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**[ 3 marks ]**

- (d) Experimental procedure:

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**[ 3 marks ]**

- (e) Variables:

- (i) Manipulated

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(ii) Responding

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(iii) Controlled

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[ 3 marks ]

(f) Expected results:

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[ 1 mark ]

(g) Treatment of results:

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[ 1 mark ]

(h) Chemical principle used in (g):

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[ 1 mark ]

**Total 14 marks**

**END OF TEST**

**IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.**