

Centre Number						Candidate Number					
Surname						Other Names					
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<b>Candidate Declaration.</b> I have read and understood the Notice to Candidate and can confirm that I have produced the attached work without assistance other than that which is acceptable under the scheme of assessment.											
Candidate Signature						Date					

For Teacher's Use	
Section	Mark
PSA	
Task	
Section A	
Section B	
TOTAL ISA MARK (max 50)	



General Certificate of Education  
Advanced Level Examination  
June 2013

# Chemistry

# CHM6T/P13/test

## Unit 6T A2 Investigative Skills Assignment

### Written Test

For submission by 15 May 2013

<b>For this paper you must have:</b> <ul style="list-style-type: none"> <li>the Periodic Table/Data Sheet provided at the end of this paper</li> <li>the Task Sheet and your Candidate Results Sheet</li> <li>a ruler with millimetre measurements</li> <li>a calculator.</li> </ul>	<b>Time allowed</b> <ul style="list-style-type: none"> <li>1 hour</li> </ul>
<b>Instructions</b> <ul style="list-style-type: none"> <li>Use black ink or black ball-point pen.</li> <li>Fill in the boxes at the top of this page.</li> <li>Answer <b>all</b> questions.</li> <li>You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.</li> <li>Do all rough work in this book. Cross through any work you do not want to be marked.</li> </ul>	<b>Information</b> <ul style="list-style-type: none"> <li>The marks for questions are shown in brackets.</li> <li>The maximum mark for this paper is 30.</li> <li>You are expected to use a calculator, where appropriate.</li> <li>You will be marked on your ability to:             <ul style="list-style-type: none"> <li>organise information clearly</li> <li>use scientific terminology accurately.</li> </ul> </li> </ul>

**Details of additional assistance (if any).** Did the candidate receive any help or information in the production of this work? If you answer yes give the details below or on a separate page.

Yes  No

#### Teacher Declaration:

I confirm that the candidate's work was conducted under the conditions laid out by the specification. I have authenticated the candidate's work and am satisfied that to the best of my knowledge the work produced is solely that of the candidate.

Signature of teacher ..... Date .....

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**There are no questions printed on this page**

**DO NOT WRITE ON THIS PAGE  
ANSWER IN THE SPACES PROVIDED**

**Section A**

These questions are about the task, an investigation of some organic compounds.

You should use your Task Sheet and your Candidate Results Sheet to answer these questions.

Answer **all** questions in the spaces provided.

When answering questions **1**, **2** and **3** you should assume that in **Test 2** potassium manganate(VII) behaves as an oxidising agent in a similar way to potassium dichromate(VI). When the potassium manganate(VII) reacts as an oxidising agent it forms a solution that appears colourless.

- 1** Use your observations from the Task to identify the functional group most likely to be present in **B** and the functional group most likely to be present in **D**.

Functional group in **B** .....

Functional group in **D** .....

(2 marks)

- 2** State, with a reason, whether or not your observations from **Tests 1, 2** and **3** allow you to identify the functional group most likely to be present in **C**.

.....  
.....  
.....

(1 mark)

- 3** State, with a reason, whether or not your observations from **Tests 1, 2** and **3** allow you to deduce that **A** contains more than one functional group.

.....  
.....  
.....

(1 mark)

- 4** Infrared spectroscopy can be used to distinguish between organic compounds. Use **Table 1** on the Data Sheet to identify the wavenumber of an absorption that would allow you to distinguish between an aldehyde and a carboxylic acid.

.....

(1 mark)

Turn over ►

5 Aldehydes can be prepared from acyl chlorides.

State how an aldehyde could be tested to show whether it is contaminated with traces of unreacted acyl chloride.

State what you would observe.

Test .....

Observation .....

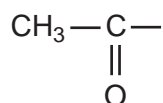
.....  
(2 marks)

6 Suggest **one** reason why Tollens' reagent is used as the oxidising agent in the specific test for aldehydes rather than the less expensive acidified potassium dichromate(VI).

.....

.....  
(1 mark)

7 The triiodomethane reaction is often used as a test for aldehydes and ketones that contain the  $\text{CH}_3\text{CO}$  group shown.



The aldehyde or ketone is reacted with an alkaline solution of iodine. Triiodomethane ( $\text{CHI}_3$ ) is formed as a precipitate. Compounds that contain a group that can be oxidised to the  $\text{CH}_3\text{CO}$  group will also give a positive result in this test.

7 (a) State, with a reason, whether or not ethanol will give a positive result in the triiodomethane reaction.

.....

.....

.....  
(1 mark)



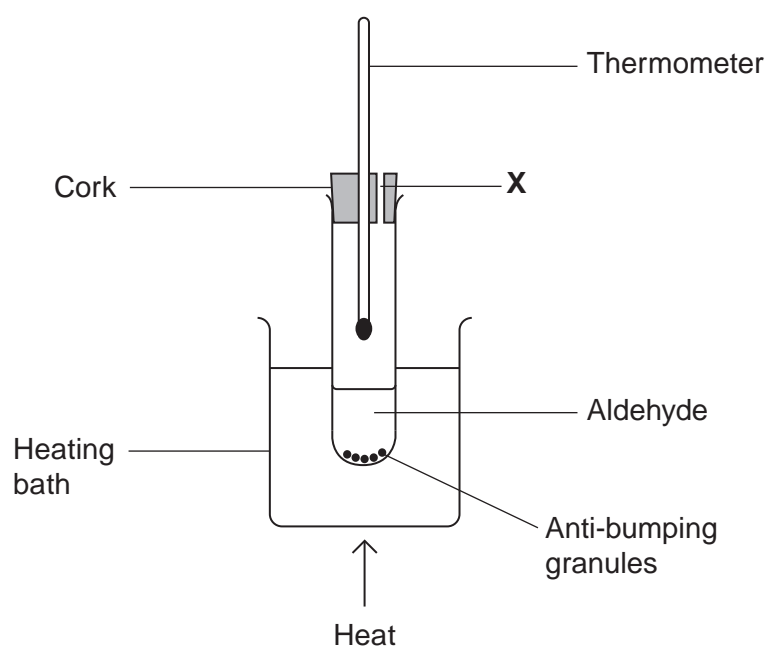
**Section B**

Answer **all** questions in the spaces provided.

- 8** At a given pressure, a pure liquid boils at a constant temperature. This boiling point can be used to help identify the liquid. One procedure for measuring the boiling point of an aldehyde is shown in the diagram.

**Procedure**

- Set up the apparatus as shown in the diagram. Make sure that the bulb of the thermometer is about 3 cm above the level of the aldehyde.



- Add a few anti-bumping granules to the aldehyde.
- Heat the liquid in the beaker gently until the aldehyde begins to boil. The boiling point of the aldehyde is greater than 150 °C.
- Adjust the heat source so that the aldehyde boils gently.
- Record the temperature when it becomes steady.
- Record the atmospheric pressure.

**8 (a)** State the purpose of the anti-bumping granules.

.....  
(1 mark)

**8 (b)** Give **one** reason why it is essential for the cork to have the hole, labelled **X**, in it.

.....  
.....  
(1 mark)

**8 (c)** State **two** properties that a liquid must have to make it suitable for use in the heating bath in this boiling point determination.

Property 1 .....

.....

.....

Property 2 .....

.....

.....  
(2 marks)

**8 (d)** State why the atmospheric pressure was recorded.

.....  
(1 mark)

**8 (e)** State why the boiling point of a compound may be insufficient on its own to identify the compound.

.....  
.....  
(1 mark)

Turn over ►





## GCE Chemistry Data Sheet

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Table 1

Infrared absorption data

Bond	Wavenumber /cm <sup>-1</sup>
N-H (amines)	3300 – 3500
O-H (alcohols)	3230 – 3550
C-H	2850 – 3300
O-H (acids)	2500 – 3000
C≡N	2220 – 2260
C=O	1680 – 1750
C=C	1620 – 1680
C-O	1000 – 1300
C-C	750 – 1100


Table 2

<sup>1</sup>H n.m.r. chemical shift data

Type of proton	δ/ppm
ROH	0.5 – 5.0
RCH <sub>3</sub>	0.7 – 1.2
RNH <sub>2</sub>	1.0 – 4.5
R <sub>2</sub> CH <sub>2</sub>	1.2 – 1.4
R <sub>3</sub> CH	1.4 – 1.6
$\begin{array}{c}   \\ \text{R}-\text{C}-\text{C}- \\    \quad   \\ \text{O} \quad \text{H} \end{array}$	2.1 – 2.6
$\begin{array}{c}   \\ \text{R}-\text{O}-\text{C}- \\   \\ \text{H} \end{array}$	3.1 – 3.9
RCH <sub>2</sub> Cl or Br	3.1 – 4.2
$\begin{array}{c}   \\ \text{R}-\text{C}-\text{O}-\text{C}- \\    \quad   \\ \text{O} \quad \text{H} \end{array}$	3.7 – 4.1
$\begin{array}{c} \text{H} \\   \\ \text{R}-\text{C}=\text{C}- \\   \quad   \end{array}$	4.5 – 6.0
$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}-\text{H} \end{array}$	9.0 – 10.0
$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}-\text{O}-\text{H} \end{array}$	10.0 – 12.0

Table 3

<sup>13</sup>C n.m.r. chemical shift data

Type of carbon	δ/ppm
$\begin{array}{c}   \\ -\text{C}- \\   \end{array}$	5 – 40
$\begin{array}{c}   \\ \text{R}-\text{C}-\text{Cl or Br} \\   \end{array}$	10 – 70
$\begin{array}{c}   \\ \text{R}-\text{C}-\text{C}- \\    \quad   \\ \text{O} \end{array}$	20 – 50
$\begin{array}{c}   \\ \text{R}-\text{C}-\text{N}- \\   \quad   \end{array}$	25 – 60
$\begin{array}{c}   \\ -\text{C}-\text{O}- \\   \end{array}$	50 – 90
alcohols, ethers or esters	
$\begin{array}{c} \diagup \\ \text{C}=\text{C} \\ \diagdown \end{array}$	90 – 150
R-C≡N	110 – 125
	110 – 160
$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}- \\   \end{array}$	160 – 185
esters or acids	
$\begin{array}{c} \text{O} \\    \\ \text{R}-\text{C}- \\   \end{array}$	190 – 220
aldehydes or ketones	

Turn over ►

