

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**

**GCSE**

**B741/02**

**GATEWAY SCIENCE**

**CHEMISTRY B**

**Chemistry modules C1, C2, C3  
(Higher Tier)**

**FRIDAY 6 JUNE 2014: Afternoon**

**DURATION: 1 hour 15 minutes  
plus your additional time allowance**

**MODIFIED ENLARGED**

<b>Candidate forename</b>		<b>Candidate surname</b>	
-------------------------------	--	------------------------------	--

<b>Centre number</b>						<b>Candidate number</b>				
--------------------------	--	--	--	--	--	-----------------------------	--	--	--	--

**Candidates answer on the Question Paper.  
A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:**

**Periodic table**

**OTHER MATERIALS REQUIRED:**

**Pencil**

**Ruler (cm/mm)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

**Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**

**Use black ink. HB pencil may be used for graphs and diagrams only.**

**Answer ALL the questions.**

**Read each question carefully. Make sure you know what you have to do before starting your answer.**

**Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).**

## **INFORMATION FOR CANDIDATES**

**The quality of written communication is assessed in questions marked with a pencil () .**

**The number of marks is given in brackets [ ] at the end of each question or part question.**

**The total number of marks for this paper is 75.**

**Any blank pages are indicated.**

**BLANK PAGE**

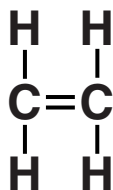
Answer ALL the questions.

**SECTION A – Module C1**

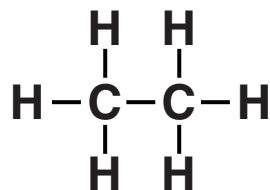
**1 This question is about compounds containing carbon.**

**Look at the displayed formulas of some compounds.**

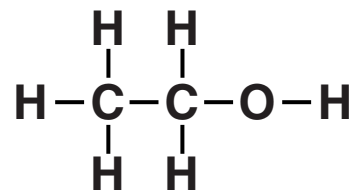
**compound A**



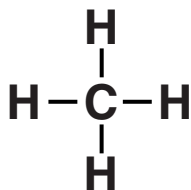
**compound B**



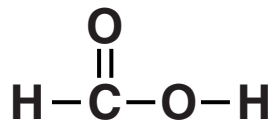
**compound C**



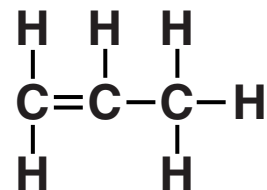
**compound D**



**compound E**



**compound F**



**(a) What is the MOLECULAR FORMULA for compound B?**

\_\_\_\_\_

**[1]**

**(b) Explain why compound B is a hydrocarbon but compound C is not a hydrocarbon.**

---

---

---

---

**[3]**

**(c) Two compounds are UNSATURATED.**

**Which two?**

\_\_\_\_\_ and \_\_\_\_\_ **[1]**

**[TOTAL: 5]**

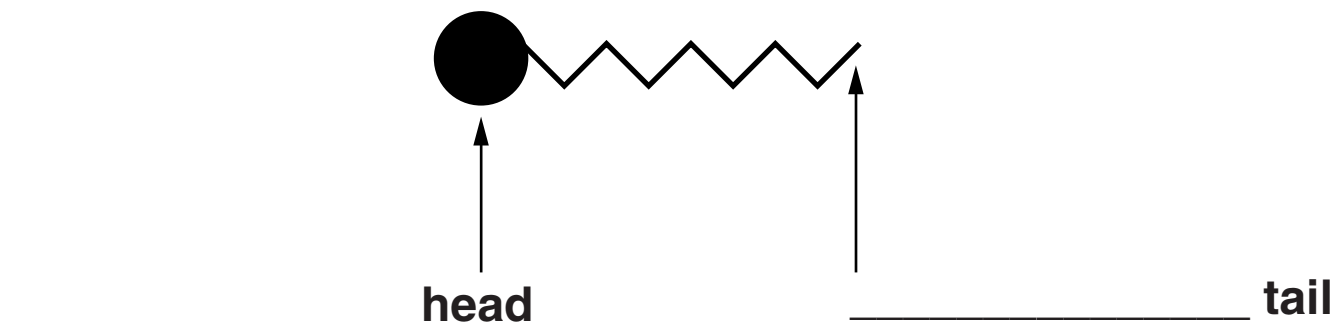
**2 This question is about emulsifiers and cooking.**

**(a) Mayonnaise is a mixture of an emulsifier, an oil and water.**

**The emulsifier helps to stop the oil and water from separating.**

**Look at the structure of an emulsifier molecule below.**

**(i) Label the two parts of the emulsifier molecule. [1]**



**(ii) Explain how an emulsifier helps to stop oil and water from separating.**

---

---

---

---

---

---

---

---

**[2]**

**(b) Egg yolk is a runny liquid.**

**The egg yolk becomes a solid when it is cooked.**

**Explain why.**

**Use ideas about the type of molecules in egg yolk.**

---

---

---

---

---

**[2]**

**[TOTAL: 5]**

**3 A power station burns methane, CH<sub>4</sub>.**

**(a) Construct a BALANCED SYMBOL equation for the complete combustion of methane.**

\_\_\_\_\_ [2]

**(b) The power station produces nitrogen dioxide gas.**

**The owners need to stop the nitrogen dioxide going into the atmosphere.**

**They can choose two methods:**

**use limestone**

**use sea water.**

**Look at the table. It shows some information about each method.**

	<b>Limestone</b>	<b>Sea water</b>
<b>Percentage of nitrogen dioxide removed</b>	<b>90%</b>	<b>99%</b>
<b>Waste made</b>	<b>carbon dioxide and a solid waste product</b>	<b>none – sea water is pumped back into the sea</b>
<b>Cost</b>	<b>expensive</b>	<b>cheap</b>
<b>Availability</b>	<b>mined from under the ground</b>	<b>must be pumped in from the coast</b>
<b>Mass needed to remove 1 g of nitrogen dioxide</b>	<b>1.2 g</b>	<b>3000 g</b>



**The power station is 100 kilometres from the coast.**

**The power station makes 9000 g of nitrogen dioxide.**

**Which method would be more suitable for removing nitrogen dioxide from the waste gases?**

**Explain your answer.**

---

---

---

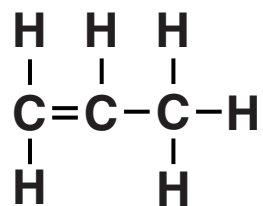
---

**[2]**

**[TOTAL: 4]**

**4 Poly(propene) is a polymer made from propene.**

**Look at the displayed formula for propene.**



**(a) Draw the displayed formula for poly(propene). [2]**



---

---

---

---

---

**[TOTAL: 8]**

**5 An oil paint contains oil, a solvent, a binder and a phosphorescent pigment.**

**(a) A phosphorescent pigment will glow in the dark.**

**Explain why.**

---

---

---

**[2]**

**(b) A layer of oil paint is left to dry and harden.**

**The solvent evaporates.**

**What happens to the oil?**

---

---

**[1]**

**[TOTAL: 3]**

## **SECTION B – Module C2**

**6 Many different materials are needed to build a car.**

**(a) (i) Suggest a property of glass that makes it useful for making a car windscreen.**

\_\_\_\_\_ [1]

**(ii) Some car bodies are now built from aluminium instead of steel.**

**One advantage of using aluminium is that it is less dense than steel.**

**Write down ONE OTHER ADVANTAGE of building car bodies from aluminium instead of steel.**

\_\_\_\_\_ [1]

**(b) Look at the table below.**

**It shows information about some of the materials used to build a car.**

<b>Material</b>	<b>Density in g/cm<sup>3</sup></b>	<b>Electrical conductivity</b>	<b>Flexibility</b>
<b>aluminium</b>	<b>2.7</b>	<b>very high</b>	<b>low</b>
<b>glass</b>	<b>2.5</b>	<b>very low</b>	<b>low</b>
<b>PVC</b>	<b>1.4</b>	<b>very low</b>	<b>high</b>
<b>steel</b>	<b>7.8</b>	<b>high</b>	<b>low</b>

**Explain why PVC is used for covering the electrical wires in a car.**

**Use the information from the table.**

---

---

---

**[2]**

**[TOTAL: 4]**

**7 This question is about fertilisers.**

**(a) Ammonium sulfate,  $(\text{NH}_4)_2\text{SO}_4$ , is used as a fertiliser.**

**Complete the table to show the number of ATOMS OF EACH ELEMENT in the formula for ammonium sulfate.**

<b>Element</b>	<b>Number of atoms</b>
<b>nitrogen</b>	
<b>hydrogen</b>	
<b>sulfur</b>	
<b>oxygen</b>	

**[1]**



**(b) Ammonium sulfate is made by reacting an acid with an alkali.**

**Name the acid and alkali needed.**

**Describe how the acid and alkali are used to make a sample of ammonium sulfate.**

---

---

---

---

---

---

---

---

**[3]**

**(c) Nitric acid is used to manufacture fertilisers.**

**Ammonia,  $\text{NH}_3$ , and oxygen,  $\text{O}_2$  are used to manufacture nitric acid,  $\text{HNO}_3$ .**

**Water is the other product.**

**The reaction between ammonia and oxygen uses the following conditions:**

**a temperature of  $900^\circ\text{C}$**

**atmospheric pressure**

**a platinum catalyst.**



**8 This question is about the structure of the Earth.**

**(a) It is difficult for scientists to study the structure of the Earth.**

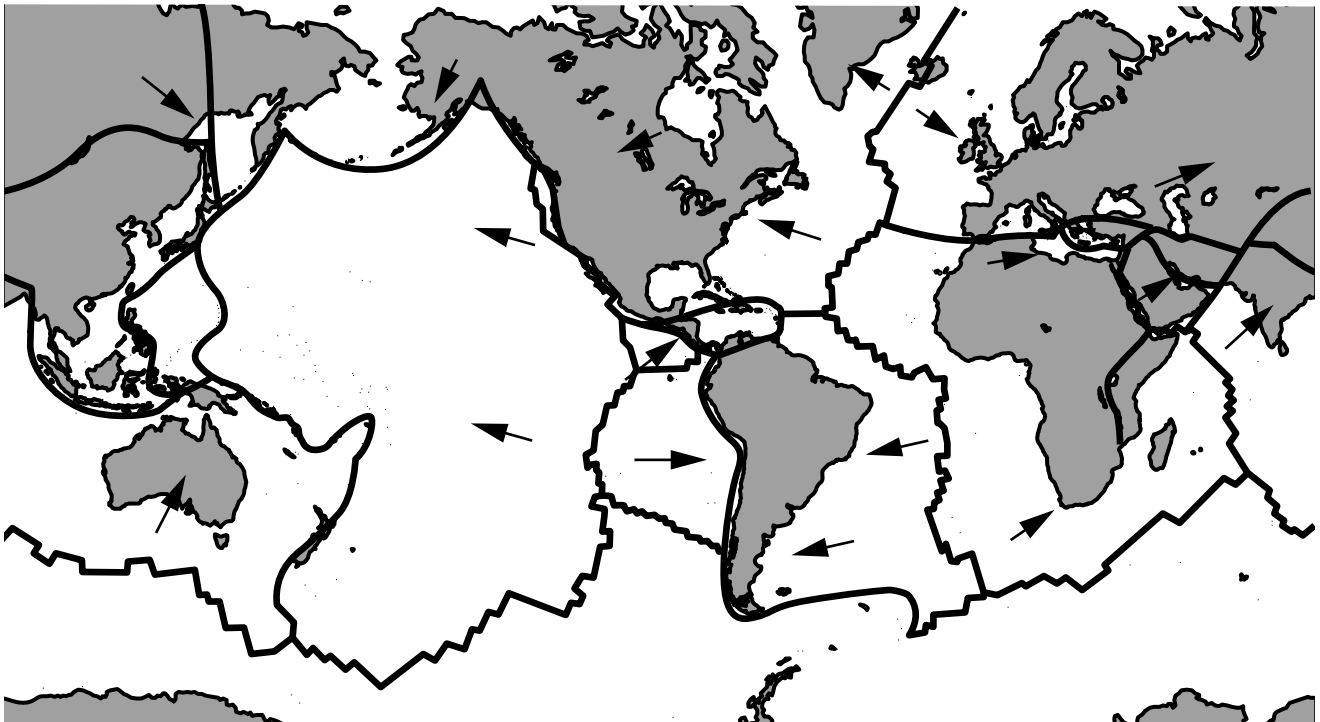
**Explain why.**

---

---

[1]

**(b) The Earth's crust is made up of tectonic plates that move slowly.**



**The THEORY OF PLATE TECTONICS developed over many years.**

- (i) Write about TWO stages in the DEVELOPMENT of the theory of plate tectonics.**

---

---

---

---

---

---

---

---

**[2]**

- (ii) Why do most scientists now accept this developed theory?**

---

---

**[1]**

**[TOTAL: 4]**

**9 This question is about metals.**

**(a) Phil wants to buy a new bicycle.**

**He uses the internet to research which metal is the most suitable for making the bicycle frame.**

**Look at the table.**

**It shows the information he finds out.**

<b>Metal</b>	<b>Density in g/cm<sup>3</sup></b>	<b>Relative strength (1= low, 10 = high)</b>	<b>Resistance to corrosion</b>	<b>Cost per tonne in £</b>
<b>aluminium</b>	<b>2.7</b>	<b>0.9</b>	<b>very good</b>	<b>2220</b>
<b>copper</b>	<b>8.9</b>	<b>2.1</b>	<b>good</b>	<b>5550</b>
<b>stainless steel</b>	<b>7.8</b>	<b>7.3</b>	<b>very good</b>	<b>900</b>
<b>titanium</b>	<b>4.5</b>	<b>10</b>	<b>very good</b>	<b>17 000</b>

**Which metal is the most suitable for making Phil's bicycle frame?**

\_\_\_\_\_

**Explain your answer using information from the table.**

---

---

---

---

---

---

**[3]**

**(b) Pure copper is used for electrical wiring.**

**The copper is purified by ELECTROLYSIS.**

**The diagram opposite shows the apparatus used to purify copper.**

**Complete the labels on the diagram opposite.**

**Choose your answers from the list below.**

**copper sulfate solution**

**dilute sulfuric acid**

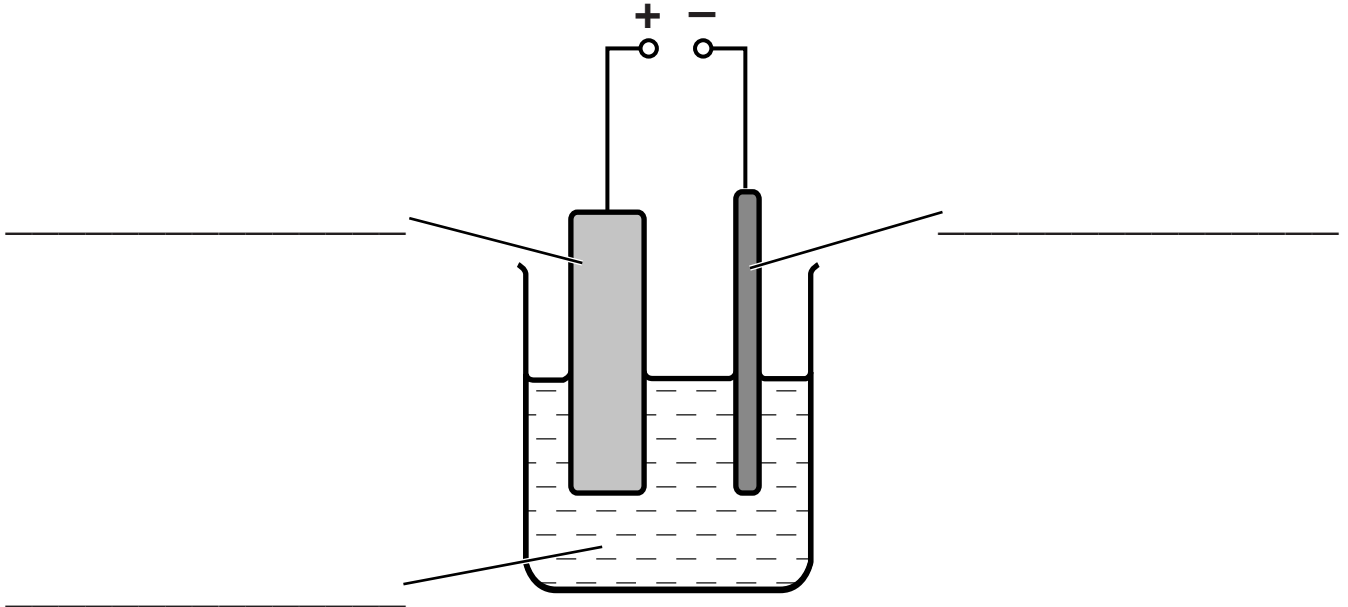
**impure copper anode**

**impure copper cathode**

**pure copper anode**

**pure copper cathode**

power pack

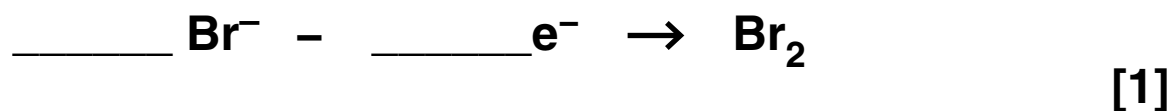


[2]

[TOTAL: 5]

**10 During the electrolysis of sodium bromide solution, bromide ions make bromine molecules.**

**(a) Complete the equation for this reaction.**



**(b) Explain why this reaction is an example of OXIDATION.**

\_\_\_\_\_

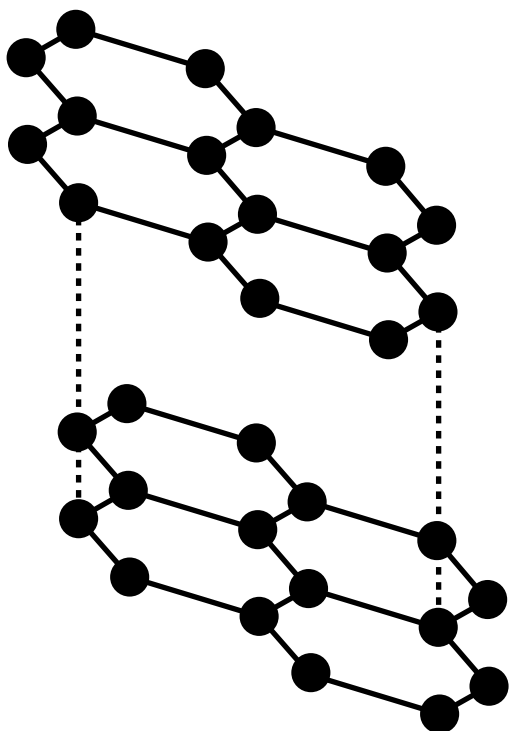
\_\_\_\_\_ **[1]**

**[TOTAL: 2]**



## SECTION C – Module C3

11 Graphite is one of the allotropes of carbon.



(a) Graphite is used to make pencil leads.

Explain why the properties of graphite make it suitable for pencil leads.

---

---

---

---

[2]

**(b) Graphite is used as an electrode in electrolysis.**

**This is because it conducts electricity and has a high melting point.**

**(i) Explain why graphite can conduct electricity.  
Use the diagram on page 25 to help you.**

---

---

**[1]**

**(ii) Explain why graphite has a high melting point.  
Use the diagram on page 25 to help you.**

---

---

---

---

**[2]**

**[TOTAL: 5]**

**12 Rachel investigates the reaction between magnesium and hydrochloric acid.**

**She adds a piece of magnesium ribbon to hydrochloric acid in a beaker.**

**Rachel measures the time it takes for all the magnesium ribbon to react.**

**This is the reaction time.**

**She does five different experiments.**

**Rachel's prediction is, 'The larger the volume of acid and the greater the mass of magnesium, the shorter the reaction time.'**

**Look at Rachel's results.**

<b>Experiment number</b>	<b>Mass of magnesium used in g</b>	<b>Volume of acid used in cm<sup>3</sup></b>	<b>Concentration of acid in mol/dm<sup>3</sup></b>	<b>Reaction time in seconds</b>
<b>1</b>	<b>0.05</b>	<b>25</b>	<b>1.0</b>	<b>30</b>
<b>2</b>	<b>0.10</b>	<b>25</b>	<b>1.0</b>	<b>30</b>
<b>3</b>	<b>0.05</b>	<b>50</b>	<b>1.0</b>	<b>30</b>
<b>4</b>	<b>0.05</b>	<b>50</b>	<b>2.0</b>	<b>15</b>
<b>5</b>	<b>0.10</b>	<b>50</b>	<b>2.0</b>	<b>15</b>



**(b) Rachel repeats experiment 1. This time she uses acid at a HIGHER temperature.**

**Explain, using the reacting particle model, what happens to the rate of reaction.**

---

---

---

---

---

**[2]**

**[TOTAL: 8]**

13 Ethanoic acid,  $\text{C}_2\text{H}_4\text{O}_2$ , can be made by several different processes.

Three of these are process R, process S and process T.

(a) In process R, methanol reacts with carbon monoxide.



Process R has 100% atom economy.

Explain how you can tell this from the symbol equation.

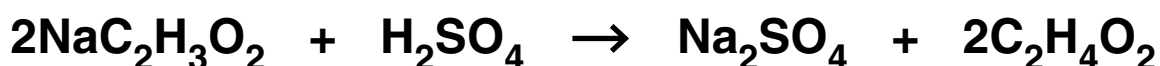
---

---

---

[1]

(b) In process S, sodium ethanoate,  $\text{NaC}_2\text{H}_3\text{O}_2$ , reacts with sulfuric acid.



Look at the table of relative formula masses,  $M_r$ .

Substance	Relative formula masses, $M_r$
$\text{NaC}_2\text{H}_3\text{O}_2$	82
$\text{H}_2\text{SO}_4$	98
$\text{Na}_2\text{SO}_4$	142
$\text{C}_2\text{H}_4\text{O}_2$	60

- (i) A mass of 8.2 g of sodium ethanoate reacts with excess sulfuric acid.

What mass of ethanoic acid,  $C_2H_4O_2$ , can be made?

---

---

---

---

---

mass of ethanoic acid = \_\_\_\_\_ g  
[2]

- (ii) Calculate the ATOM ECONOMY for process S.

Sodium sulfate,  $Na_2SO_4$ , is a waste product.

---

---

---

atom economy = \_\_\_\_\_ %  
[2]

**(c) In process T, hydrocarbons are oxidised to make ethanoic acid.**

**Mike predicts that 5.2 tonnes of ethanoic acid should be made.**

**The factory actually makes 2.4 tonnes of ethanoic acid.**

**(i) Calculate the percentage yield of ethanoic acid.**

**Write your answer to TWO significant figures.**

---

---

---

**percentage yield = \_\_\_\_\_ %**  
**[2]**

**(ii) Describe one disadvantage of having a percentage yield of this value.**

---

---

**[1]**

**[TOTAL: 8]**



**BLANK PAGE**

**14 Paraffin is a liquid fuel.**

**Paraffin releases heat energy when it burns in air.**

**Jenna wants to find out how much energy is released when she burns 1 g of paraffin.**

**She decides to use the paraffin to heat some water.**

**Write about how she does the experiment. You may wish to include a labelled diagram. [4]**

---

---

---

---

---

---

---

---

---

---

**[TOTAL: 4]**

**END OF QUESTION PAPER**



### Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website ([www.ocr.org.uk](http://www.ocr.org.uk)) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact the Copyright Team, First Floor, 9 Hills Road, Cambridge CB2 1GE.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

