

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GCSE**

**A171/02**

**TWENTY FIRST CENTURY SCIENCE  
CHEMISTRY A/SCIENCE A**

**Modules C1 C2 C3 (Higher Tier)**

**THURSDAY 14 MAY 2015: Morning**

**DURATION: 1 hour  
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:**

**Insert for question 1**

**A copy of the 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 60.**

**Any blank pages are indicated.**

**BLANK PAGE**

**Answer ALL the questions.**

- 1 Beijing is a city in China where there are many coal-fired power stations.**

**Coal-fired power stations pollute the air with solid particles.**

- (a) The chart on the insert shows pollution from solid particles in Beijing for the first 12 days of January 2013.**

**The safe level for solid particles is a daily average of  $25\mu\text{g}/\text{m}^3$ .**

**An emergency health warning is triggered when the level of solid particles is greater than  $300\mu\text{g}/\text{m}^3$ .**

- (i) Use this information and the chart to find out if these statements are TRUE or FALSE over these 12 days.**

**Put ticks (✓) in the correct boxes.**

	<b>TRUE</b>	<b>FALSE</b>
<b>There are 3 days when the solid particles are BELOW the safe level.</b>		
<b>The MAXIMUM pollution shown on the chart is 36 times the safe level.</b>		
<b>The MEAN is always more than half the MAXIMUM on any day.</b>		
<b>The level of solid particles triggers an emergency health warning on 6 days.</b>		

**[2]**

- (ii) The table shows solid particles in six samples of air taken on 13<sup>th</sup> January.

<b>Solid particles in <math>\mu\text{g}/\text{m}^3</math></b>	<b>150</b>	<b>200</b>	<b>250</b>	<b>500</b>	<b>400</b>	<b>300</b>
---	------------	------------	------------	------------	------------	------------

**What is the mean of this data?  
Show your working.**

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

- (iii) Use data in the table and your answer to (ii) to complete the chart on the insert.

**Show MAXIMUM and MEAN solid particles for  
13<sup>th</sup> January.** [2]

- (iv) Joe and Tanya look at the chart on the insert. Joe says the chart shows pollution in Beijing is increasing. Tanya says that the chart does not give enough evidence for this conclusion.

**Explain why both Joe and Tanya could be correct.**

---

---

---

---

**[3]**

**(b) Which of these statements explains why solid carbon particles may be made when coal burns?**

**Put ticks (✓) in the boxes next to the TWO correct answers.**

**Sulfur in the coal reacts with carbon.**

☐

**Coal is mainly carbon atoms.**

☐

**Coal is made up of carbon and hydrogen atoms.**

☐

**There is not enough oxygen for all the carbon to react.**

☐

**Carbon dioxide is reduced by nitrogen in the air.**

☐

**The hydrogen atoms react more slowly than the carbon atoms.**

☐

**[2]**

**[TOTAL: 10]**

- 2 The early atmospheres on Earth and on Mars were similar.  
They BOTH contained mainly CARBON DIOXIDE and WATER VAPOUR.**

**The atmospheres on the two planets are now very different.**

**The table shows the composition of the atmosphere on Mars now.**

<b>GAS</b>	<b>COMPOSITION NOW (%)</b>
<b>carbon dioxide</b>	<b>95</b>
<b>oxygen</b>	<b>traces</b>
<b>water vapour</b>	<b>traces</b>
<b>other gases</b>	<b>4</b>

**The average surface temperature of Mars is now  $-55^{\circ}\text{C}$ .**

**Use the information to describe how the atmosphere on Mars has changed. Compare these changes to what has happened to the atmosphere on Earth. Give reasons for the changes to the Earth's atmosphere. [6]**





**The quality of written communication will be assessed in your answer.**

---

---

---

---

---

---

---

---

---

---

**[TOTAL: 6]**

**3 Nitrogen dioxide is an air pollutant.**

**(a) Here are some statements about how cars make nitrogen dioxide.**

**Not all the statements are correct.**

- A Nitrogen from the fuel reacts with oxygen in the air.**
- B Nitrogen and oxygen from the air react together.**
- C Fuel burning in the engine gives high temperatures.**
- D Nitrogen oxide is oxidised in the air.**
- E Nitrogen dioxide is reduced by carbon monoxide.**
- F Nitrogen oxide is made.**
- G Nitrogen dioxide is made.**

**Choose the FIVE correct statements from A, B, C, D, E, F and G.**

**Put these in the correct order in the boxes. One has been done for you.**

				<b>G</b>
--	--	--	--	----------

**[3]**

**(b) Nitrogen dioxide does not stay in the air.**

**How is nitrogen dioxide removed from the air?**

**Put a tick (✓) in the box next to the correct answer.**

**It is used by plants to make nitrogen.**

☐

**It is oxidised to nitrogen in catalytic converters.**

☐

**It reacts with carbon deposited on surfaces.**

☐

**It reacts with water and oxygen.**

☐

**[1]**

**[TOTAL: 4]**

- 4 Tennis balls used in competitions must have a similar bounce.**  
**The balls are dropped onto concrete and the height of the bounce is measured.**

**(a) Why must the tennis balls be dropped onto the same surface?**

**Put a tick(✓) in the box next to the correct answer.**

**Tennis courts are made of different materials.**

☐

**Changing the surface affects the outcome.**

☐

**So that the bounce height can be measured accurately.**

☐

**So that the balls do not bounce too high.**

☐

**[1]**

- (b) Ben needs 120 tennis balls for a local competition. He measures the bounce of 100 tennis balls. This is what he finds.**

<b>HEIGHT OF BOUNCE</b>	<b>NUMBER OF TENNIS BALLS</b>
<b>up to 130 cm</b>	<b>4</b>
<b>131 to 135 cm</b>	<b>16</b>
<b>136 to 140 cm</b>	<b>52</b>
<b>141 to 145 cm</b>	<b>28</b>
<b>146 to 150 cm</b>	<b>0</b>
<b>greater than 150 cm</b>	<b>0</b>

**For the competition the bounce range must be between 136 cm and 145 cm.**

- (i) How many tennis balls would you expect Ben to check before he has 120 suitable for the competition?**

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

- (ii) Josie watches Ben test the tennis balls.  
Josie says he should test each tennis ball more than once.  
Is she right? Explain why.

---

---

[1]

- (c) The polymer used to make tennis balls has been modified.  
It reacts with sulfur to form cross-links.  
Plasticisers are added.

How do these modifications affect the properties of the polymer?

Complete the table. Choose from these words.

DECREASES  
INCREASES  
STAYS THE SAME

	Hardness	Melting point	Stiffness
Cross-linking			
Adding a plasticiser			

[2]

[TOTAL: 6]

**BLANK PAGE**

**5 (a) Dave is buying new ropes for his boat.**

**Look at the properties of four synthetic fibres used to make ropes.**

	<b>Kevlar</b>	<b>Nylon</b>	<b>Polyester</b>	<b>Polypropene</b>
<b>Tensile strength in N/mm<sup>2</sup></b>	<b>210</b>	<b>70</b>	<b>70</b>	<b>65</b>
<b>Stiffness in MN m/kg</b>	<b>80</b>	<b>2</b>	<b>3</b>	<b>1</b>
<b>Density in g/cm<sup>3</sup></b>	<b>1.44</b>	<b>1.14</b>	<b>1.38</b>	<b>0.91</b>
<b>Floats on water or sinks</b>	<b>sinks</b>	<b>sinks</b>	<b>sinks</b>	<b>floats</b>
<b>Water absorbency in %</b>	<b>4.5</b>	<b>6.0</b>	<b>0.5</b>	<b>negligible</b>

**The best ropes are made from fibres which are strong, flexible and light, even when wet.**

**Which fibre would make the best rope for Dave's boat?**

**Use the data to help you explain why you would choose that fibre and not the others. [6]**





**The quality of written communication will be assessed in your answer.**

---

---

---

---

---

---

---

---

---

---

- (b) In countries where there is no chemical industry, ropes are made from plant material. Suggest reasons why plant material, and not synthetic material, is used to make ropes.**

---

---

---

---

**[2]**

**[TOTAL: 8]**

- 6 This is a question about crude oil.  
Crude oil is separated by fractional distillation.  
This is possible because the compounds in crude oil  
boil at different temperatures.**

**(a) These sentences are about what happens in  
fractional distillation.**

**Which TWO sentences explain why the  
compounds in crude oil boil at DIFFERENT  
temperatures?**

**Put ticks (✓) in the boxes next to the TWO correct  
answers.**

**Energy is needed to break the  
molecules.** ☐

**Energy is needed to heat each  
compound to its boiling point.** ☐

**Gas molecules have stronger forces  
between them than liquid molecules.** ☐

**Larger molecules have larger forces  
between them.** ☐

**More energy is needed to overcome  
strong forces than weak ones.** ☐

**The forces between atoms in a molecule  
depend on the size of that molecule.** ☐

**[2]**

**(b) The fractions from crude oil have many USES.**

**Name TWO uses of fractions from crude oil.**

1) \_\_\_\_\_

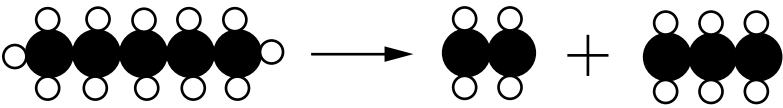
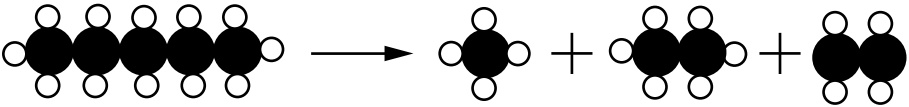
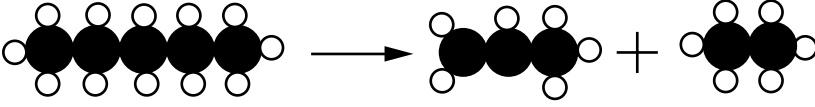
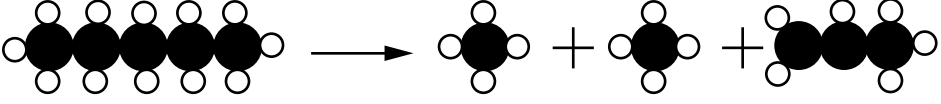
2) \_\_\_\_\_

**[2]**

**(c) Pentane is a hydrocarbon found in crude oil.  
Pentane can be broken up in a refinery.**

**The diagrams represent the rearrangement of  
atoms when pentane is broken up.  
Only ONE of them is correct.**

**Put a tick (✓) in the box next to the correct  
diagram.**

**[1]**

**[TOTAL: 5]**

- 7 The Food Standards Agency (FSA) wants us to eat less salt in our diet.**

**(a) Why should people eat less salt?**

---

---

---

---

**[2]**

- (b) (i) Most breakfast cereals contain salt.  
The table shows the salt content of four brands of breakfast cereals, A, B, C and D in 2005 and 2013.**

<b>Cereal</b>	<b>Salt content in g per 100 g</b>	
	<b>2005</b>	<b>2013</b>
<b>A</b>	<b>2.40</b>	<b>1.20</b>
<b>B</b>	<b>2.60</b>	<b>1.20</b>
<b>C</b>	<b>1.48</b>	<b>0.72</b>
<b>D</b>	<b>0.62</b>	<b>0.30</b>

**The Food Standards Agency (FSA) says that the salt in all breakfast cereals is at least 50% lower in 2013 than in 2005.**

**USE THE DATA to show whether or not the FSA statement is correct for these cereals.**

---

---

[2]

- (ii) What additional data would you need to increase your confidence that the FSA statement is true?**

---

---

---

---

[2]

**(c) Researchers are developing nanoparticle salt. Nanoparticle salt tastes 2000 times more salty than ordinary salt.**

**(i) How many grams of nanoparticle salt will be in 100 g of cereal A to give the same flavour as in 2013?**

**Put a ring around the correct answer.**

$$2.4 \times 10^{-3}$$

$$6.0 \times 10^{-3}$$

$$6.0 \times 10^{-4}$$

$$2.4 \times 10^{-5}$$

$$6.0 \times 10^{-5}$$

**[1]**

**(ii) Some people think nanoparticle salt should replace normal salt. Other people do not.**

**Use ideas of risk and benefit to explain why people do not agree about adding nanoparticle salt to food.**

---

---

---

---

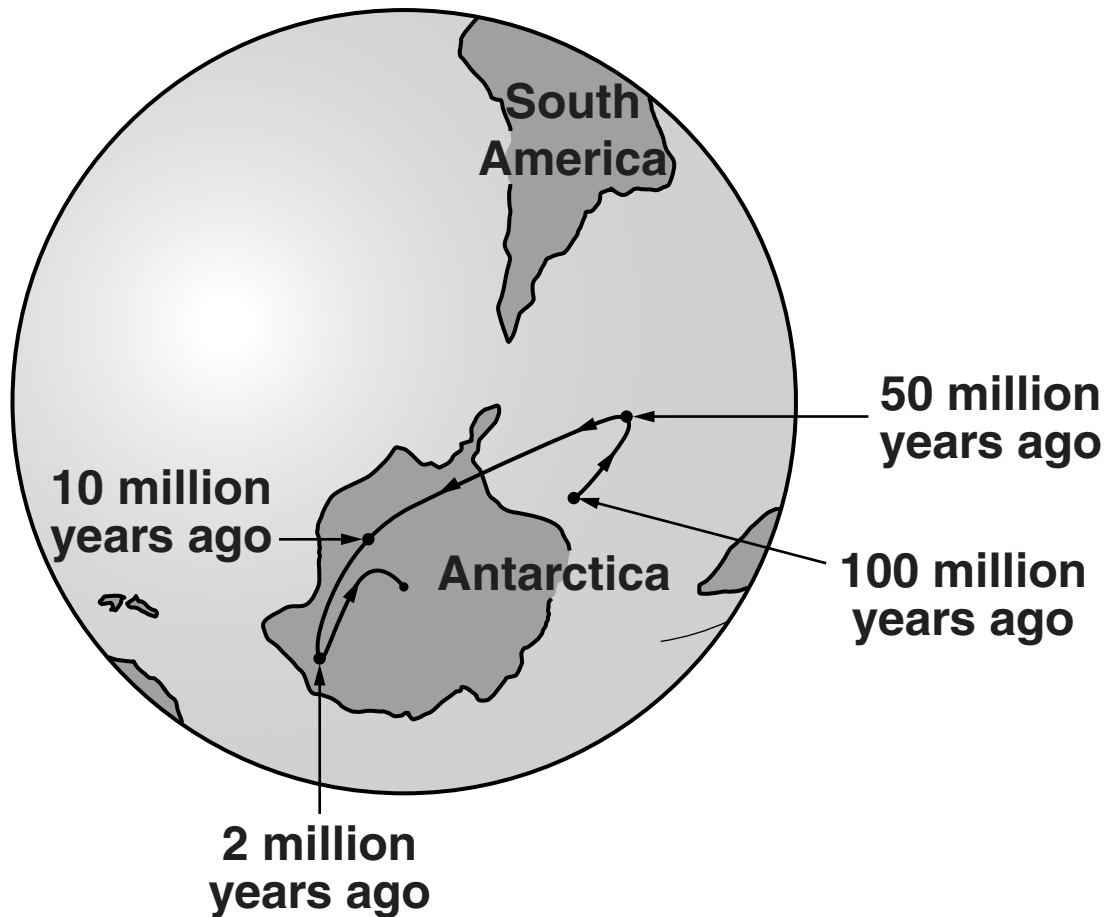
**[2]**

**[TOTAL: 9]**

**BLANK PAGE**

**8 The diagram shows the position of Antarctica today.**

 The line shows how Antarctica has moved across the surface of the Earth over the past 100 million years.





- (a) Geologists use data on the direction of magnetism of some rocks to show movement of continents.

Explain how geologists would use this data to show the movement of Antarctica.



The quality of written communication will be assessed in your answer.

---

---

---

---

---

---

---

---

---

---

---

[6]

**(b) How do continents such as Antarctica move over the surface of the Earth?**

**Put ticks (✓) in the boxes next to the TWO correct answers.**

**Sediment is laid down over millions of years.**

☐

**Continents are parts of tectonic plates.**

☐

**There are hot-water springs on the ocean floor where tectonic plates meet.**

☐

**Earthquakes and volcanoes occur at the edges of tectonic plates.**

☐

**Tectonic plates move.**

☐

**[2]**

**[TOTAL: 8]**

- 9 Mercury has been used in the chemical industry for hundreds of years.  
Nowadays its use is strictly regulated because it is toxic.**

**(a) How do some toxic chemicals cause environmental and health problems?**

---

---

---

---

**[2]**

**(b) Mercury was known to harm humans 150 years ago.  
It was widely used until very recently.**

**Suggest reasons why people continued to use mercury even though they knew it was harmful.**

---

---

---

---

**[2]**

**[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.

