



Oxford Cambridge and RSA

**Thursday 2 November 2017 – Afternoon**
**GCSE TWENTY FIRST CENTURY SCIENCE  
CHEMISTRY A/SCIENCE A**
**A171/02 Modules C1 C2 C3 (Higher Tier)**

\* 2 7 4 0 6 7 8 9 0 \*

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

**OCR supplied materials:**

None

**Other materials required:**

- Pencil
- Ruler (cm/mm)

**Duration: 1 hour**


Candidate forename						Candidate surname					
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Centre number						Candidate number				
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**INSTRUCTIONS TO CANDIDATES**

- Write your name, centre number and candidate number in the boxes above. 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. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

**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**.
- This document consists of **20** pages. Any blank pages are indicated.

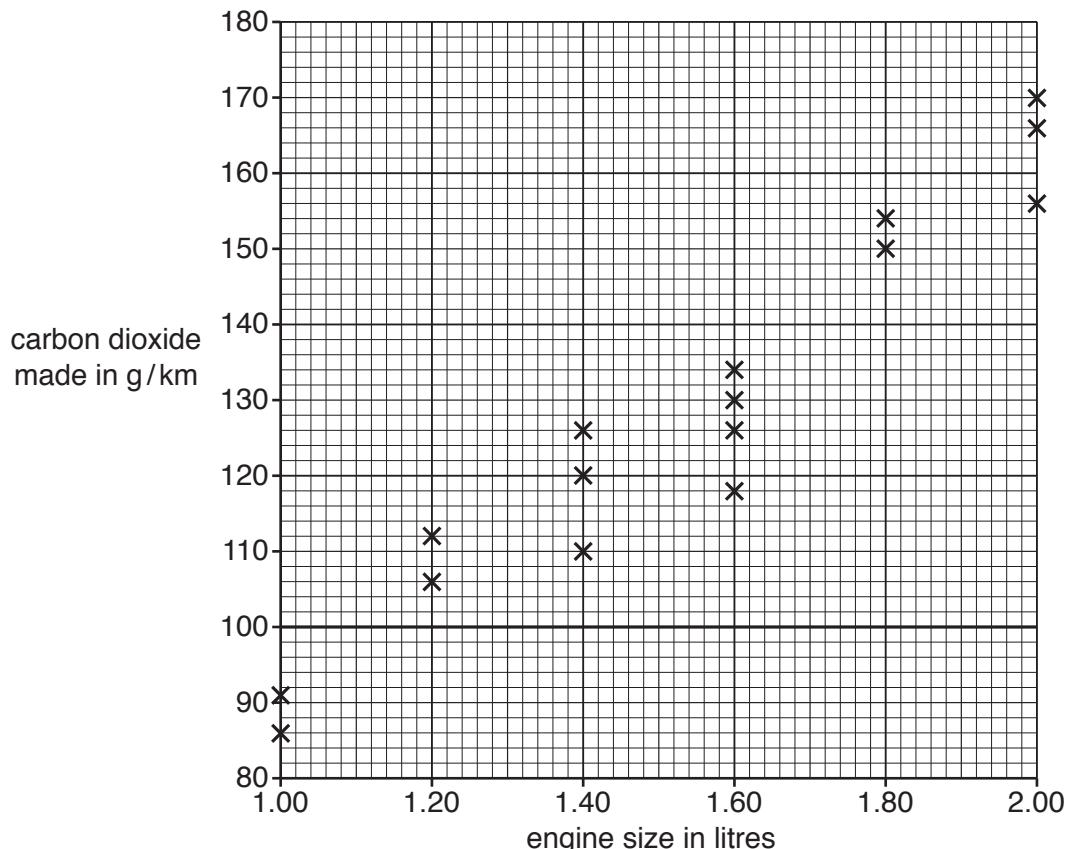
Answer **all** the questions.

1 Car engines make carbon dioxide.

Look at the chart.

It shows the carbon dioxide made by 16 different car engines when the car drives for 1 kilometre.

The mass of carbon dioxide made is plotted against the size of each car engine.



(a) (i) What correlation is shown by the chart?

..... [1]

(ii) What is the range of values of the amount of carbon dioxide for 1.6 litre engines?

..... to ..... g/km

[1]

(iii) Suggest a reason why different cars with the same engine size make different amounts of carbon dioxide. Explain your answer.

.....  
.....  
.....  
..... [2]

(b) Before April 2017 owners of cars that made less than 100g carbon dioxide per kilometre did not pay Vehicle Excise Duty (road tax).  
In 2016 Jay bought a new car.  
The car engine was tested.  
The engine made 490 kg carbon dioxide for every 5000 km the car was driven.  
(1 kg = 1000 g)

In the box, show that Jay did not have to pay road tax on his new car in 2016.

[2]

**[Total: 6]**

**Question 2 begins on page 4**

2 People who go camping often cook on a barbecue.



(a) When charcoal burns in a barbecue, some carbon monoxide is made.

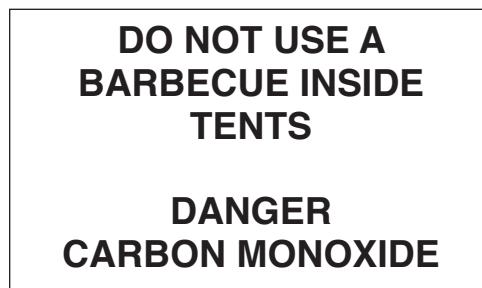
Charcoal is mainly carbon.

Complete the diagram that shows carbon reacting with oxygen to make carbon monoxide.



[2]

(b) Read this notice.



(i) Why is carbon monoxide dangerous?

Explain your answer.

.....

.....

.....

.....

[2]

(ii) The notice says 'Do not use a barbecue inside tents'.  
Why does using the barbecue outdoors reduce the danger from carbon monoxide?

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

[2]

**[Total: 6]**

**Question 3 begins on page 6**

3 (a) Carbon monoxide and nitrogen dioxide are air pollutants. These gases come from many different sources. In 1993 emissions from cars were a major source of these pollutants.

The table shows amounts of carbon monoxide and nitrogen oxides put into the air from all sources in 1993 and 2013.

	<b>Amount of gas put into the air from all sources in tonnes</b>	
	<b>1993</b>	<b>2013</b>
<b>Carbon monoxide</b>	1200	550
<b>Nitrogen oxides</b>	2500	1350

Catalytic converters have been fitted into new cars since 1993.

Explain the changes between 1993 and 2013 in car emissions by writing about the reactions that make these air pollutants and the reactions in a catalytic converter.



*The quality of written communication will be assessed in this question.*

[6]

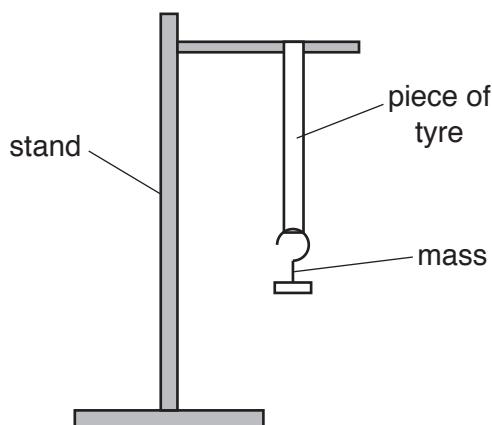
(b) Catalytic converters on cars are a legal regulation.

Write down **one** other regulation which improves air quality and explain how it works.

[2]

[Total: 8]

4 Three groups of students investigate how much a piece of bike tyre stretches. They hang masses on the piece of tyre. They increase the mass and measure the increase in length.



(a) Name **one** factor that must be controlled in this investigation. Explain how this makes it a fair test.

.....

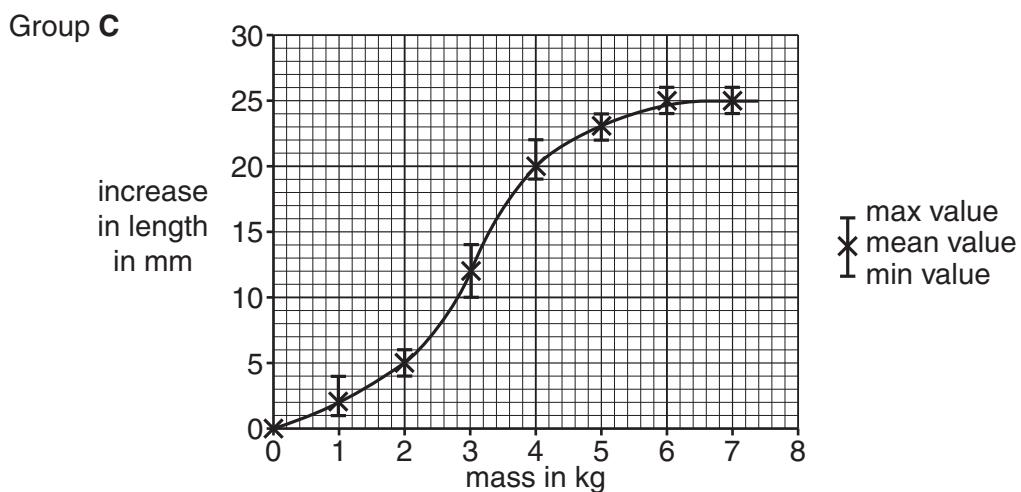
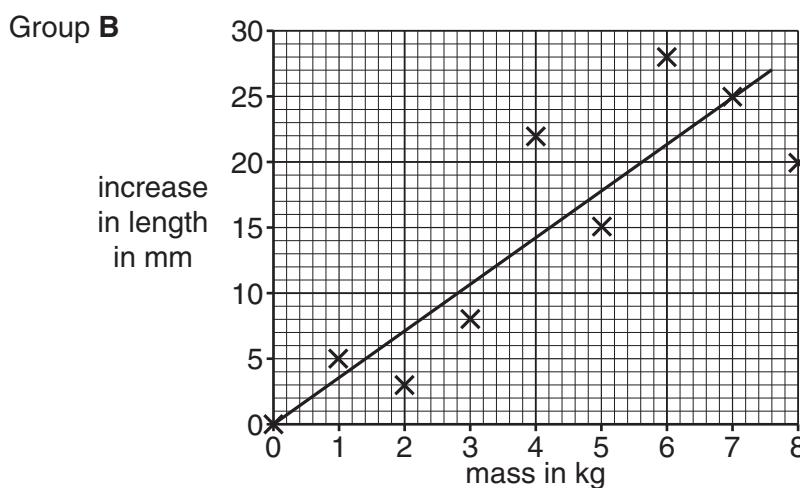
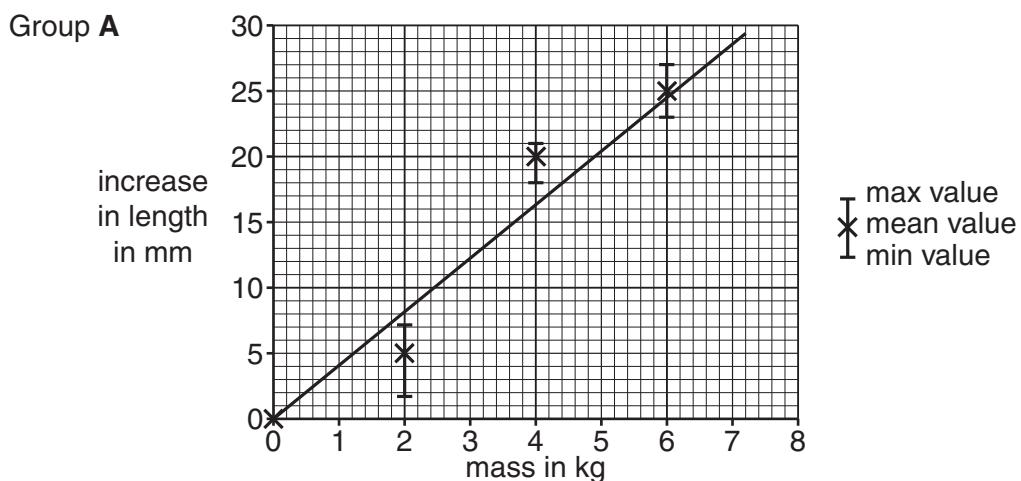
.....

.....

.....

[2]

(b) The results from each group are plotted on graphs.  
Here are the graphs from the three groups of students.



Group **C** have the best results. Explain why group **C**'s results are better than groups **A** and **B**. Use group **C**'s graph to write a conclusion for the investigation.



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

[6]

[6]

[Total: 8]

10

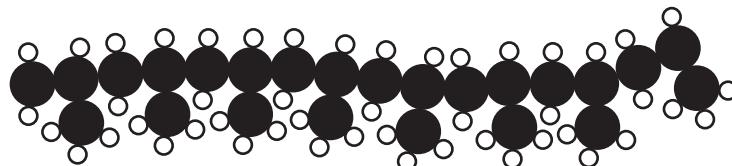
5 This is a question about chemicals that are made from crude oil.

(a) Which of the statements about crude oil are true and which are false?  
Put a tick (✓) in the correct box in each row.

	true	false
Most molecules in crude oil contain carbon, hydrogen and oxygen atoms.		
Molecules in crude oil have different chain lengths.		
Crude oil is refined by fractional distillation.		
More crude oil is used for chemical synthesis than is used for fuel.		

[3]

(b) Polymers are made by joining together small molecules.  
This diagram shows part of a polypropene molecule.



(i) Draw the monomer of polypropene.  
Use the diagram above to help you.

[1]

(ii) How many of these monomers join together to make the part of the polypropene molecule shown in the diagram above?

answer ..... [1]

(iii) What is the name of the process that changes the monomers into polypropene?

..... [1]

(c) Polymers can be modified to change their properties.  
 How do these modifications change the **melting point** of the polypropene?  
 Put a tick (✓) in the correct box in each row.

	Melting point decreases	Melting point stays the same	Melting point increases
Adding a plasticizer			
Increasing the crystallinity			
Increasing the length of the molecules			

[2]

(d) If a polymer is cooled down it reaches a temperature at which it becomes stiff and snaps when it is bent. The polymer has become **brittle**.

Different polymers become brittle at different temperatures.

The table gives this temperature and the melting point for three polymers, **A**, **B** and **C**.

	Temperature at which the polymer becomes brittle in °C	Melting point in °C
<b>Polymer A</b>	0	164
<b>Polymer B</b>	-5	157
<b>Polymer C</b>	-20	148

(i) Which polymer should be used to make the drawers in a freezer which works at -18 °C?  
 Explain your answer.

.....  
 .....  
 .....  
 ..... [2]

(ii) Suggest why a polymer is stiff and brittle at a low temperature.

.....  
 .....  
 .....  
 ..... [2]

[Total: 12]

6 Some scientists are looking at the Life Cycle Assessment (LCA) of two shirts made from two new fibres.

One shirt uses fibres made from bamboo. Bamboo grows faster than any other plant in the world. The other shirt uses a polymer that is made from crude oil.

Here is data on the LCA of each shirt.

	Shirt made from bamboo fibre	Shirt made from polymer fibre		
	Energy in MJ	Water use in litres	Energy in MJ	Water use in litres
<b>Making fibres from raw materials</b>	5.6	35	6.0	15
<b>Using the fibres to make the shirt</b>	3.5	0	4.2	0
<b>Washing the shirt after it has been worn</b>	26.5	1560	26.5	1560
<b>Disposing of the shirt</b>	0.8	0	0.8	0
<b>Other information</b>	bamboo grows very quickly	polymer is made from crude oil		

(a) Use the information from the LCA to explain whether it is more sustainable to make the shirts from bamboo or polymer fibres. Suggest what extra information you would need to be sure your decision was correct.



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

13

(b) Suggest **one** way to lower the energy requirement in washing the shirt after it has been worn.

.....  
.....

[1]

[Total: 7]

Question 7 begins on page 14

7 This question is about how the surface of Britain was formed.

(a) The position of Britain has changed over time due to the movement of tectonic plates.

What evidence supports the idea of movement of tectonic plates?

Put a tick (✓) in the boxes next to the **two** correct answers.

the shapes of the continents

patterns of magnetism in the rocks

rate of erosion of mountains

solubility of minerals in the rocks

rate of evaporation of sea water

[2]

(b) Natural resources are found in rocks in Britain.

Which one of the following resources was formed by evaporation and crystallisation?

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

coal

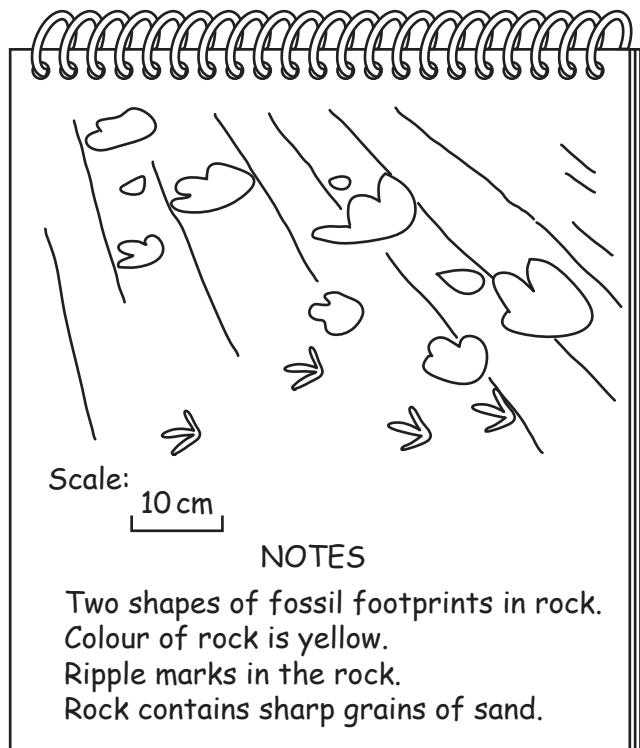
crude oil

limestone

salt

[1]

(c) This drawing and notes are about a piece of sandstone in South Wales. They were recorded by a geologist.



What conclusions could a geologist make about the history of this piece of sandstone?

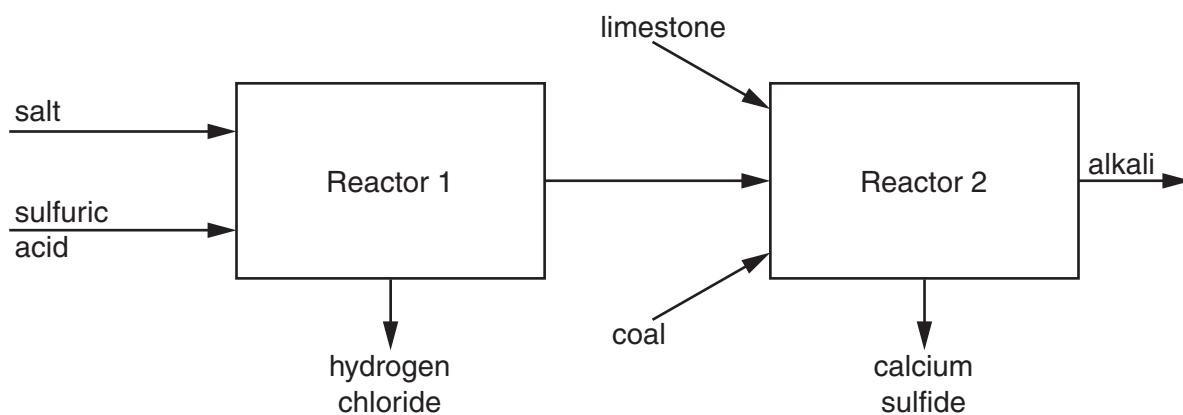
.....  
.....  
.....  
.....

[Total: 6]

8 Industrial processes for making alkalis from salt were developed in the 19<sup>th</sup> century.

(a) Process A is an old way to make alkali from salt.

Process A



Which two of the products went to waste? What problems did these waste products cause?

.....

.....

.....

.....

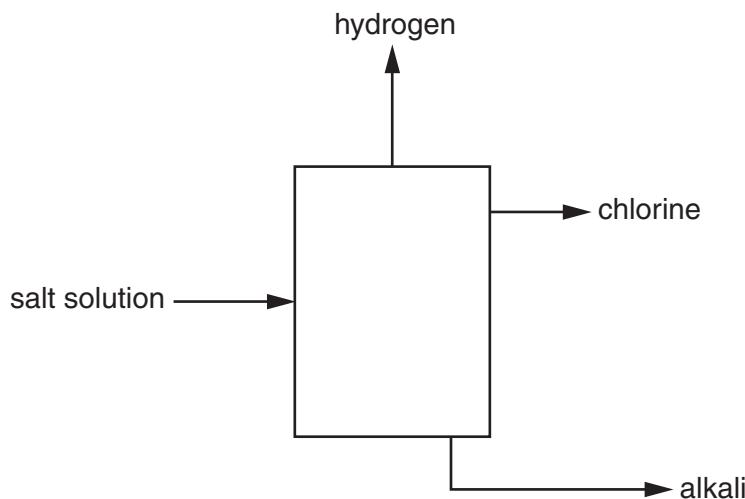
.....

.....

[3]

(b) This method of making alkali has been replaced.  
Process **B** is the modern way to make alkali from salt.

Process **B**



(i) What happens in process **B**?

Put a ring around the correct answer.

**combustion**      **distillation**      **electrolysis**      **filtration**      **neutralisation**

[1]

(ii) The products of processes **A** and **B** are different. What are the advantages of process **B**?

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

[3]

**[Total: 7]**

**END OF QUESTION PAPER**

**ADDITIONAL ANSWER SPACE**

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).





This image shows a blank sheet of handwriting practice paper. It features a vertical red line on the left side, likely representing a margin. To the right of this margin, there are 22 horizontal grey lines spaced evenly down the page, intended for practicing letter formation and alignment.



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