

**Monday 20 May 2013 – Afternoon**

**GCSE TWENTY FIRST CENTURY SCIENCE  
CHEMISTRY A**

**A171/01** Modules C1 C2 C3 (Foundation Tier)

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. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

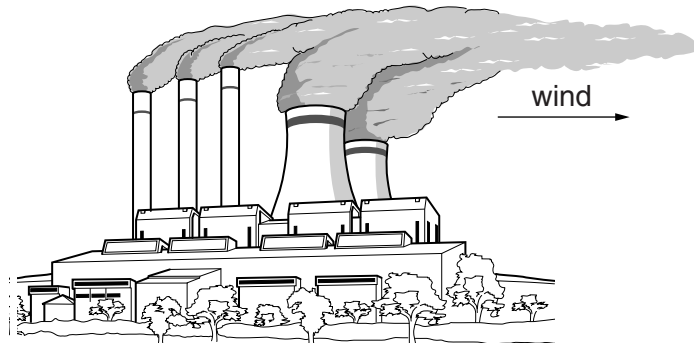
**INFORMATION FOR CANDIDATES**

- Your 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 Sulfur dioxide is released from a coal-burning power station.

Scientists study this air pollution.



They take measurements along a line from the power station in the direction the wind is blowing.

They measure the sulfur dioxide concentration in the air at different distances.

Their results are shown in the table.

<b>Distance from the power station in km</b>	1	2	3	4	5	6	7
<b>Sulfur dioxide concentration in <math>\mu\text{g}/\text{m}^3</math></b>	134	86	65	52	42	38	36

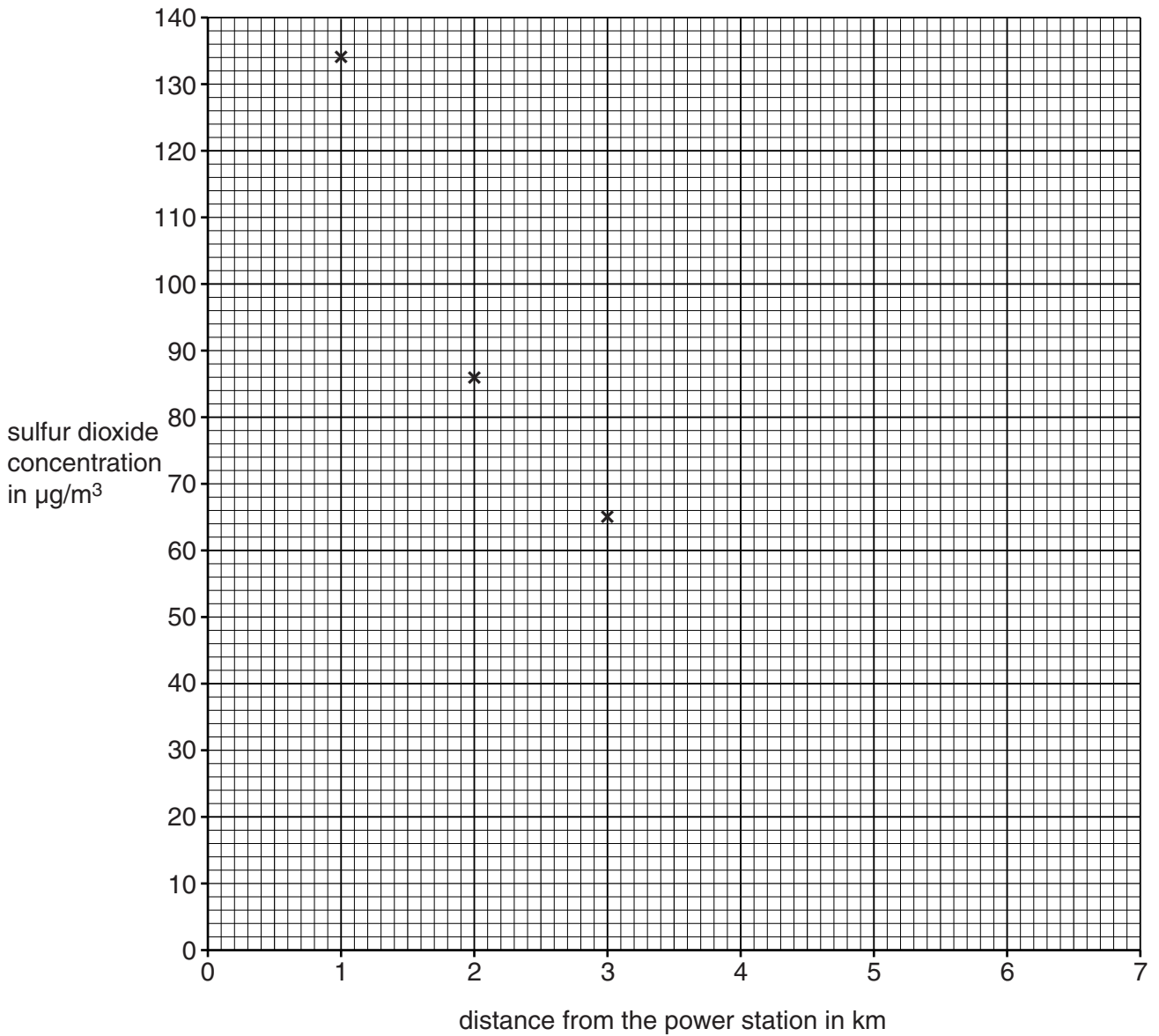
- (a) (i) Three of these results have been plotted on the graph opposite.

Plot the other results.

[2]

- (ii) Draw a curve of best fit.

[1]



(b) Finish this sentence to describe the correlation shown by the graph.

As the distance from the power station ..... the concentration of sulfur dioxide in the air ..... [1]

(c) The wind moves air pollutants from one place to another.

This could affect the measurements of sulfur dioxide.

Suggest **two other** things that could affect the measurements.

1 .....

2 .....

[2]

(d) (i) Sulfur dioxide reacts with two substances in the air to make acid rain.

Name these two substances.

1 .....

2 .....

[2]

(ii) Nitrogen dioxide also makes acid rain.

Give the formula of this gas, and write down where it comes from.

formula .....

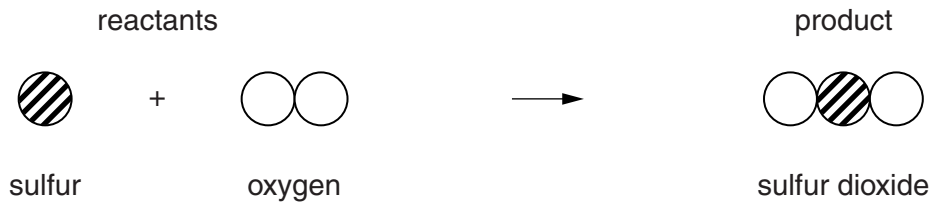
where it comes from .....

[2]

[Total: 10]

2 Sulfur is a yellow solid.

When sulfur burns in air it forms sulfur dioxide.



(a) Sam says that atoms are rearranged during chemical reactions. He thinks that the reactants and the product contain the same number of atoms of each element.

Amy says that in chemical reactions the properties of the product are different to the properties of the reactants.

Use this reaction as an example to show that both Sam and Amy are correct.



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

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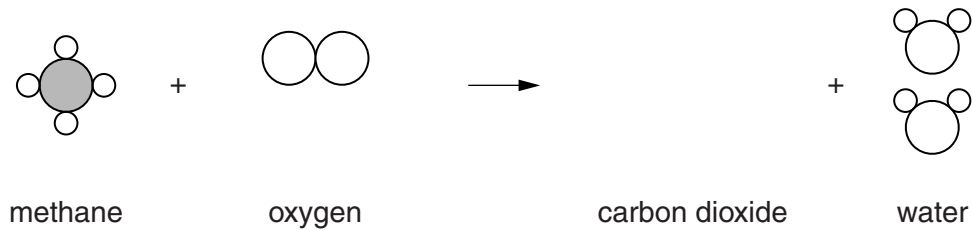
..... [6]

(b) Methane,  $\text{CH}_4$ , is a chemical in natural gas.

When methane burns in a plentiful supply of air, **complete combustion** takes place.

The products are carbon dioxide and water.

(i) Finish this diagram to show the complete combustion of one molecule of methane.



[2]

(ii) When methane,  $\text{CH}_4$ , burns in a limited supply of oxygen, **incomplete combustion** takes place.

Which of these statements about this incomplete combustion are true?

Put ticks (✓) in the boxes next to the **two** correct statements.

Not all of the carbon reacts with oxygen.

None of the hydrogen reacts with oxygen.

Water is not one of the products.

Carbon monoxide is one of the products.

Carbon is the only product.

[2]

[Total: 10]

3 Scientists working for a shoe company look at materials that could be used to make walking shoes.



The table shows some of the properties of several materials when used in shoes.

Material	Is it renewable?	Hard-wearing?	How flexible is it?	Is it waterproof?
cotton fabric	yes	low	high	no
leather	yes	high	medium	yes
nylon fabric	no	high	high	no
vulcanised rubber	yes	high	high	yes
wood	yes	low	low	yes

(a) Choose which material would be best for the upper and which would be best for the sole of these walking shoes. Give reasons for your choices.



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

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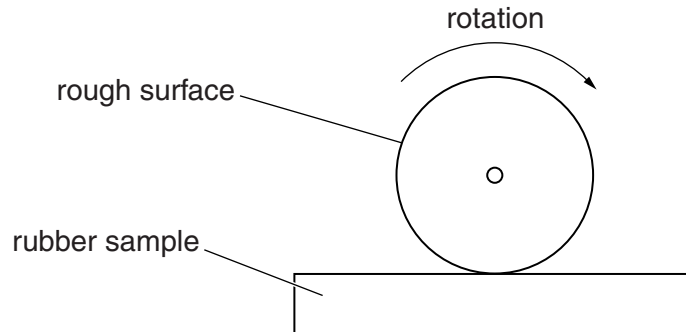
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[6]

(b) Vulcanised rubber is made by reacting natural rubber with sulfur.

Samples of vulcanised rubber and natural rubber are tested to see how hard-wearing they are.

Scientists measure the time taken to wear away 1.0 cm of the rubber.



Here are their results.

Sample number		1	2	3	4	5	6	Range	Mean
Time in mins to wear away 1.0 cm rubber	natural rubber	13	15	12	13	11	14	11–15	13
	vulcanised rubber	34	33	35	37	33	32	32–37	34

(i) Why were measurements made on several samples instead of just one?

Put ticks (✓) in the boxes next to the **two** correct statements.

It allows the procedure to be practised.

One sample could be faulty.

The mean is closer to the true value.

To make sure all samples are the same size.

Vulcanised rubber has been reacted with sulfur.

[2]



(ii) What do these results suggest about the effect of vulcanisation on rubber?

.....  
..... [1]

(iii) How sure can you be that your answer to (b)(ii) is correct?

Complete the sentences by putting a **ring** around the correct word in each box.

I am 

<b>sure</b>
<b>not sure</b>

 that my answer is correct.

This is because the 

<b>range</b>
<b>mean</b>

 of each set of results is 

<b>small</b>
<b>large</b>

 compared  
with the difference between the two sets of results.

[2]

[Total: 11]

## 4 Crude oil is a mixture of hydrocarbons.

Information about some of these hydrocarbons is given in the table.

Hydrocarbon	Formula	Melting point in °C	Boiling point in °C
methane	CH <sub>4</sub>	-182	-164
ethane	C <sub>2</sub> H <sub>6</sub>	-183	-89
propane	C <sub>3</sub> H <sub>8</sub>	-188	-42
butane	C <sub>4</sub> H <sub>10</sub>	-138	-0.5
pentane	C <sub>5</sub> H <sub>12</sub>	-130	36

(a) Which of these hydrocarbons is a liquid at 25 °C?

..... [1]

(b) (i) Finish this sentence to describe the trend shown in the table.

The ..... the hydrocarbon molecule, the .....  
its boiling point. [1]

(ii) Use ideas about energy and the forces between molecules to explain your answer.

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

[Total: 4]

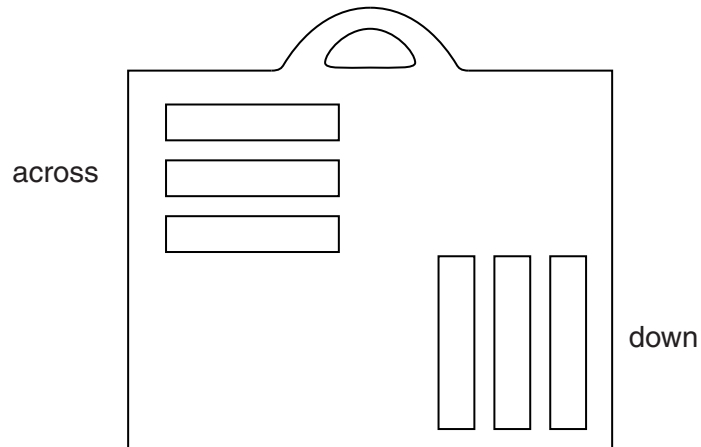
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**Question 5 begins on page 12**  
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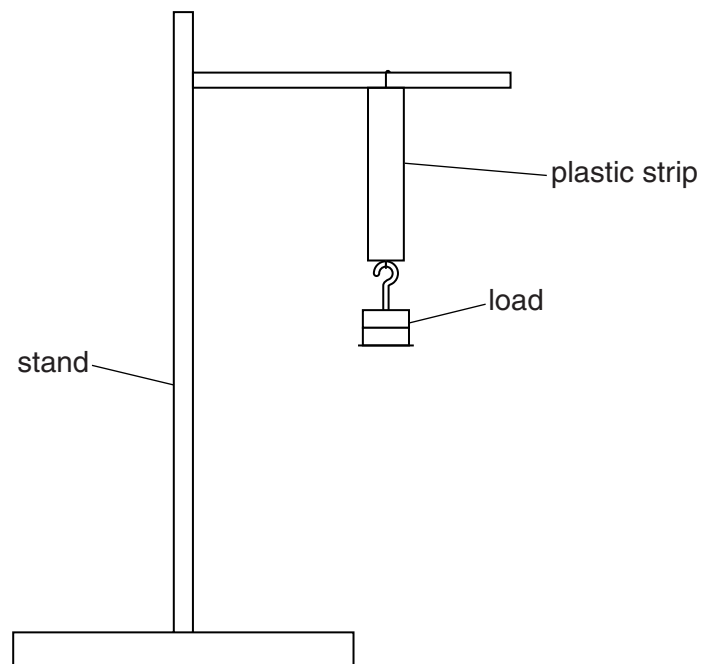
5 Students test strips of plastic from a shopping bag.

They cut some strips **down** the bag.

They cut some strips **across** the bag.



They use this apparatus.

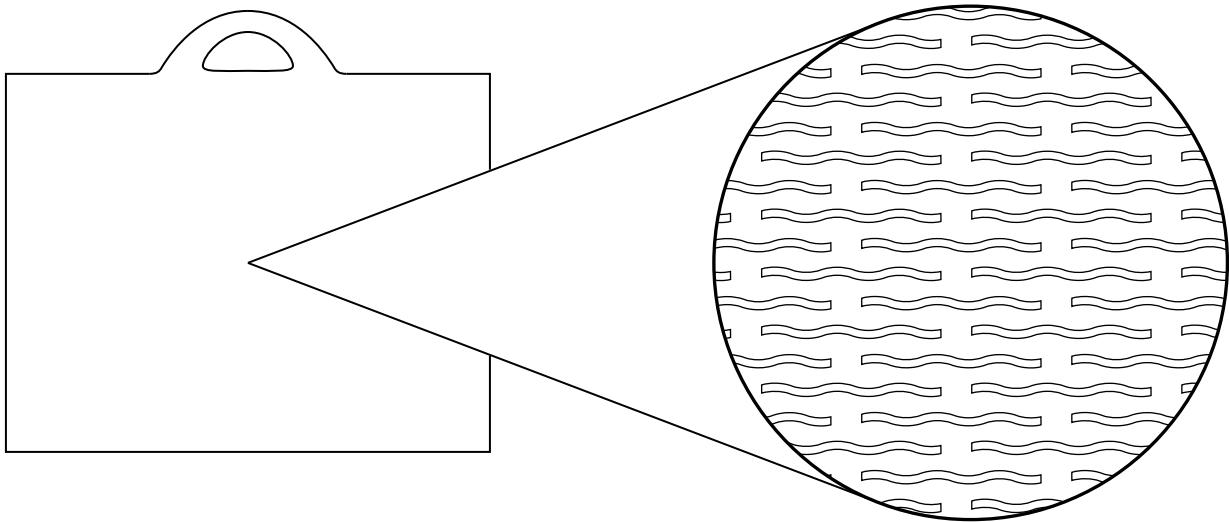


Their results are shown below.

Strips across the bag		
Load in g	Length in mm	Total stretch in mm
0	200	0
100	222	22
200	243	43
300	265	65
400	286	86
500	307	107

Strips down the bag		
Load in g	Length in mm	Total stretch in mm
0	200	0
100	209	9
200	221	21
300	231	31
400	242	42
500	252	.....

- (a) Complete the table for the strips down the bag. [1]
- (b) The diagram shows the way that the molecules are arranged in the plastic bag.



Suggest why it is easier to stretch the bag across than stretch it down.

.....

.....

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..... [2]

(c) Plastic bags have replaced paper bags for carrying shopping.

Give **another** example of a new material that has replaced an older material and **explain why**.

.....

.....

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..... [3]

[Total: 6]

6 (a) Allan is a geologist.

He discovers a layer of rock and makes some notes about it.

- A The rock is brown.
- B The rock has ripples across its surface.
- C The rock is easily scratched.
- D The rock contains shells.
- E The rock contains fossils.

Allan thinks this rock was formed under the sea.

Which observations agree with Allan's theory?

Write down the correct letters.

..... [2]

(b) In the north west of England there are large deposits of salt deep beneath the surface.

Millions of years ago this salt was dissolved in a sea.

(i) Explain how salt dissolved in this sea became solid and then ended up beneath the surface of the Earth.

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

(ii) This sea was near the equator, thousands of miles south from where England is now.

Explain how salt from a sea near the equator is now miles away from the equator.

.....  
..... [1]

(c) During the 19th century, a chemical industry formed in the north west of England because they could use the salt.

(i) Give **two other** local raw materials that enabled the industry to develop in this part of England.

1 .....  
2 ..... [2]

(ii) This industry made alkali from salt.

The process gave off hydrogen chloride gas into the air.

It also made large heaps of waste that gave off a poisonous gas called hydrogen sulfide.

Give examples of a group of people who benefited from this industry and a group of people who were harmed.

Explain your answer.

.....

.....

.....

..... [2]

[Total: 9]



- 7 Some UK food labels use a 'traffic lights' code to show how much salt they contain.

Colour	Salt content	g salt per 100 g food	Recommendation
red	high	over 1.5	eat occasionally
yellow	medium	between 0.3 and 1.5	OK to eat regularly
green	low	0.3 and below	the healthiest choice

- (a) Joe takes a packed lunch to work.

The table below shows the salt contained in each item in Joe's lunch box.

Complete the table.

Food	Mass of salt in g	Colour of 'traffic lights' code
crisps 25 g	0.5	
ham sandwich, 200 g	2.8	
apple, 100 g	0.02	

[2]

(b) Joe, Sally and Mary are buying food in a supermarket.

Mary says they should use the 'traffic lights' code to make sure they are not eating too much salt.

Joe says the 'traffic lights' code is no good since it does not tell them their daily salt intake.

Sally says it does not matter what they buy as salt is good for you.

Decide whether or not each person is correct and explain why.



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

..... [6]

(c) Health organisations recommend that people should not eat more than 6.0g of salt each day.

Many people ignore this advice and eat more than 6.0g of salt each day.

Suggest why.

..... [2]

[Total: 10]

**END OF QUESTION PAPER**

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