OCR
Oxford Cambridge and RSA

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Thursday 14 May 2015 – Morning

GCSE TWENTY FIRST CENTURY SCIENCE CHEMISTRY A/SCIENCE A

A171/01 Modules C1 C2 C3 (Foundation Tier)

4823465526

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

A171/01

Candidate forename		Candidate surname	

Centre number						Candidate number				

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

- The quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table is printed on the back page.
- 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.

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Answer **all** the questions.

1 This question is about materials.

(a) Some materials are made from living things and some materials are synthetic.

Put (rings) around the **two** materials that are made from living things.

cotton **glass** **iron** **paper** **polythene** **pottery**

[2]

(b) Synthetic materials are often made from the hydrocarbons in crude oil.

How many different elements are there in hydrocarbons?

Put a (ring) around the correct answer.

1 **2** **3** **10**

[1]

(c) Some of the materials we use are pure chemicals and some are mixtures of chemicals.

Which of these are pure chemicals and which are mixtures of chemicals?

Put ticks (✓) in the correct boxes.

	Pure chemicals	**Mixtures of chemicals**
copper		
crude oil		
sodium chloride		

[2]

[Total: 5]

2 Coal is mainly carbon.

(a) (i) When carbon burns completely carbon dioxide gas is made.

Which diagram shows a carbon dioxide molecule?

Put a (ring) around the correct diagram.

[1]

(ii) Carbon makes a different gas when it burns in less oxygen.

What is the name of this other gas?

Put a (ring) around the correct answer.

argon **carbon monoxide** **nitrogen** **sulfur dioxide**

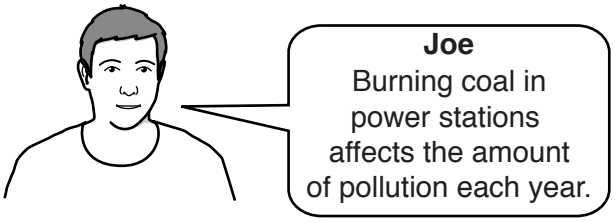
[1]

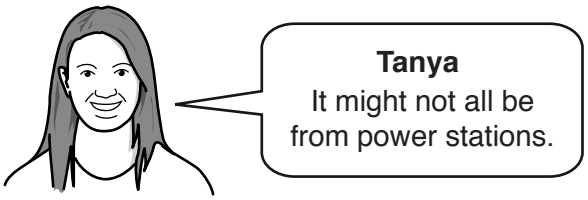
(b) Beijing is a city in China where there are many coal-fired power stations.
Coal-fired power stations pollute the air with solid particles.

The table shows the amount of coal burned in power stations near Beijing.
It also shows the number of days in each year when solid particles were above the World Health Organisation (WHO) safe level.

	2008	**2010**	**2012**
Coal burned in power stations in thousands of tonnes per year	630	750	900
Days when pollution from solid particles was above the safe level	150	175	230

Joe and Tanya talk about the data in the table.





Both Joe and Tanya could be correct.
Explain why.

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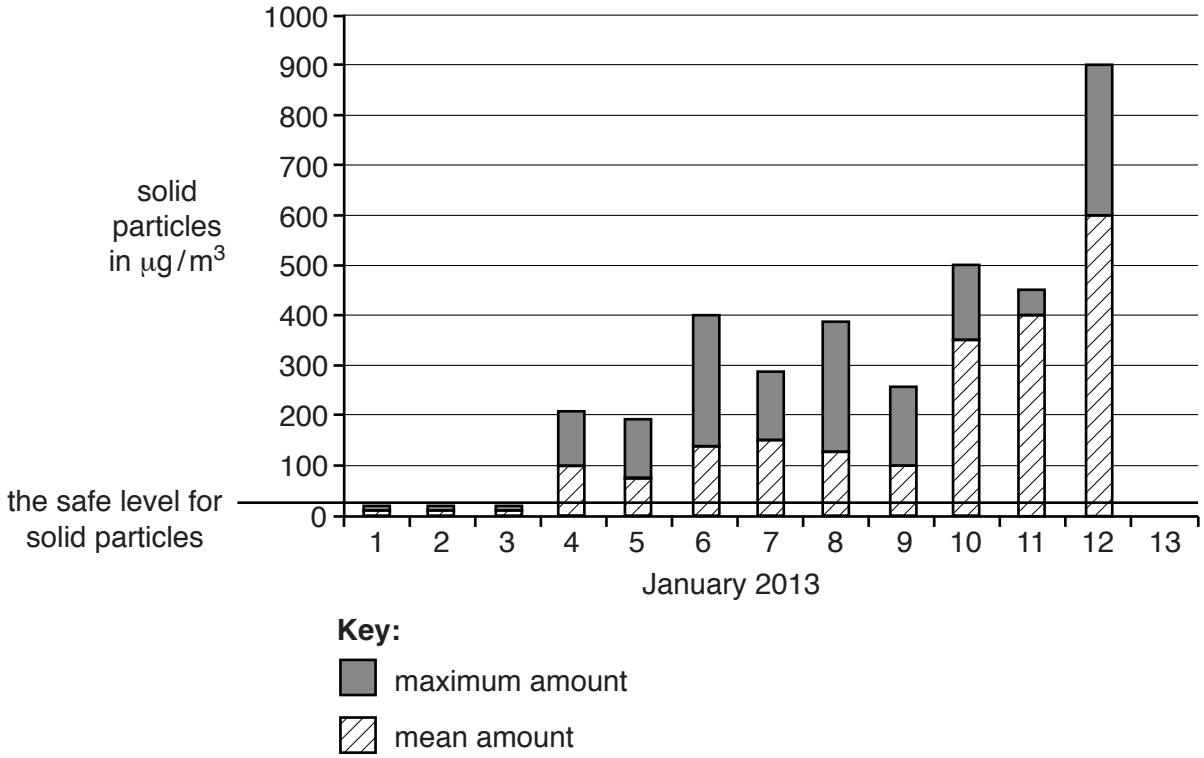
..... **[3]**

(c) The chart shows pollution from solid particles in Beijing for the first 12 days of January 2013.



(i) The safe level for solid particles is $25\,\mu g/m^3$.
This is shown on the chart.

Use the chart to find out if these statements are **true** or **false** over these 12 days.
Put ticks (✓) in the correct boxes.

	True	**False**
The **maximum** on 6th January was $400\,\mu g/m^3$.		
The **mean** on 9th January was $100\,\mu g/m^3$.		
The highest value on any day was $600\,\mu g/m^3$.		
There are only 5 days when the **mean** was **below** the safe level.		

[3]

(ii) The table shows solid particles in six samples of air taken on 13th January.

Solid particles in μg/m³	150	200	250	500	400	300

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 **opposite page**.

Show **maximum** and **mean** solid particles for 13th January. **[2]**

[Total: 11]

3 **(a)** The table shows the percentage of the three main gases in air.

Complete the table.

Name of gas	Percentage in air
_ _ _ _ _ _ _ _ _ _ _ _	78%
oxygen	21%
argon	_ _ _%

[2]

(b) The **early atmospheres** on Earth and on Mars contained **carbon dioxide** and **water vapour**.

	Early atmospheres of Earth and Mars	Atmosphere of the Earth today	Atmosphere of Mars today
Carbon dioxide	75%	0.04%	95%
Water vapour	20%	very little	very little

How have the atmospheres of Earth and Mars changed over time?
Give reasons for the changes to the Earth's atmosphere.

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

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..... **[6]**

[Total: 8]

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 measures the bounce of 50 tennis balls.
This is what he finds.

Height of bounce	Number of tennis balls
up to 130 cm	2
131 to 135 cm	8
136 to 140 cm	26
141 to 145 cm	14
146 to 150 cm	0
greater than 150 cm	0

He rejects all the tennis balls that bounce **higher** than 146 cm or **lower** than 136 cm.

(i) How many of the 50 tennis balls can he use?

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

(ii) Ben needs 120 tennis balls for a competition.
He wants to know how many tennis balls he must test.
He uses this equation:

$$\text{Number of tennis balls he must test} = \text{Number of tennis balls needed} \times \frac{50}{\text{answer to part (i)}}$$

Work out how many tennis balls Ben must test.

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

(iii) 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) Tennis balls are made from rubber.
Many small molecules react together to make long-chain molecules of rubber.

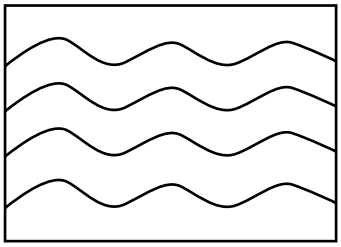
What is the name for this type of reaction?

Put a (ring) around the correct answer.

oxidation **polymerisation** **reduction** **refining**

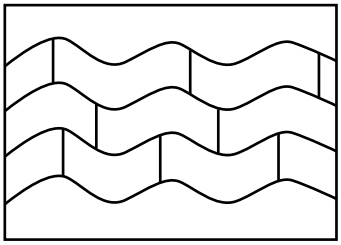
[1]

(d) This diagram shows molecules of rubber.

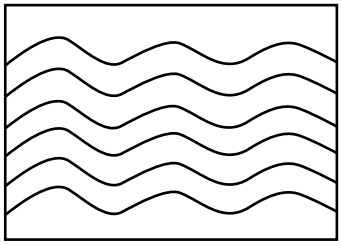


(i) Which of the diagrams **A**, **B**, or **C** shows rubber that has been **cross-linked**?

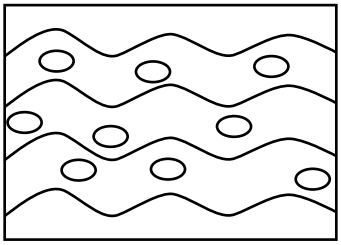
A



B



C



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

(ii) The properties of rubber are changed by cross-linking or by adding plasticiser. Complete these sentences by putting a tick (✓) in the correct box.

Cross-linking makes the rubber

harder.	
softer.	
weaker.	

Adding a plasticiser makes the rubber

have a higher melting point.	
more flexible.	
much stronger.	

[2]

[Total: 9]

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

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

	Kevlar	Nylon	Polyester	Polypropene
Tensile strength in N/mm^2	210	70	70	65
Stiffness in MNm/kg	80	2	3	1
Density in g/cm^3	1.44	1.14	1.38	0.91
Floats on water or sinks	sinks	sinks	sinks	floats
Water absorbency in %	4.5	6.0	0.5	almost 0

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.

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

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..... **[6]**

(b) In countries where there is no chemical industry, ropes are made from plant material.

Which **two** statements show the advantages of using plant material?

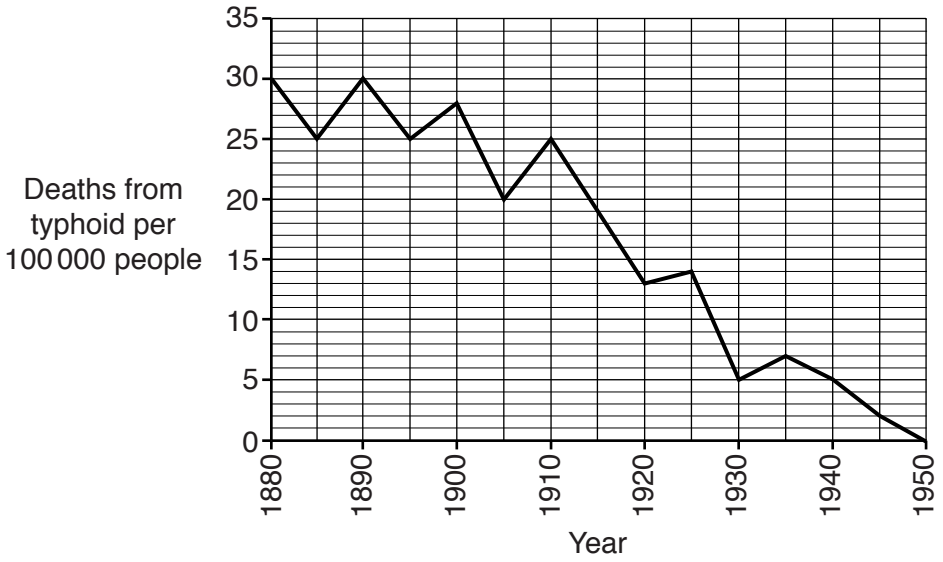
Put ticks (✓) in the boxes next to the **two** correct answers.

Ropes from plants will rot.	☐
Buying rope from other countries is expensive.	☐
Ropes from plants absorb more water than synthetic ones.	☐
There is a limited supply of plants.	☐
Making rope from plants uses local materials.	☐

[2]

[Total: 8]

6 The graph shows the deaths from typhoid in a UK city.



(a) (i) Complete the table which shows the deaths from typhoid in 1890 and 1930.

Year	Total population of city	Deaths from typhoid per 100 000 people	Total deaths from typhoid
1890	60 000	.....	18
1930	200 000	5	.....

[2]

(ii) What does the graph show about the deaths from typhoid between 1880 and 1950?

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

(b) From 1910 onwards chlorine was added to the water supply of the city.
Beth and Zac look at the graph.
They talk about the effects of adding chlorine to water.

Beth says that deaths from typhoid fell before chlorine was added to water so chlorine has no effect.

Zac says that adding chlorine to water lowers deaths from typhoid.

Who is right? Explain your answer.

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

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..... **[6]**

[Total: 10]

7 **(a)** 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.

Cereal	Salt content in g per 100 g	
	2005	**2013**
A	2.9	1.3
B	2.6	1.2
C	1.4	0.6
D	0.6	0.2

The cereals are labelled to show how much salt is in 100 g of cereal:

high salt = more than 1.5 g
medium salt = 0.3 g to 1.5 g
low salt = less than 0.3 g

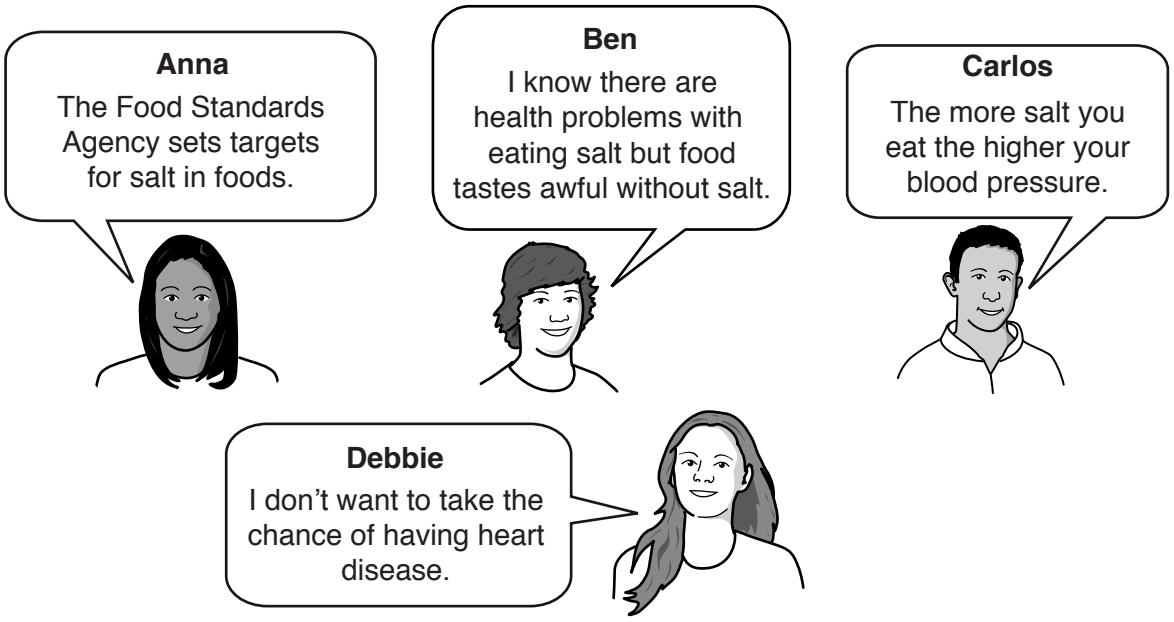
(i) Which cereal, **A**, **B**, **C** or **D**, has changed from **medium** to **low** salt between 2005 and 2013?

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

(ii) Which cereal, **A**, **B**, **C** or **D**, has **not** changed its salt label between 2005 and 2013?

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

(b) These students are talking about salt in food.



(i) Who talks about a correlation?

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

(ii) Who talks about risk and benefit?

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

(c) Government departments give advice about food.
They do risk assessments.

Why do they do risk assessments?

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

To set the safe levels of chemicals in food. ☐

To check that food is clearly labelled. ☐

To make sure there are no microbes in food. ☐

To lower the amount of salt in food. ☐

[1]

[Total: 5]

8 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?

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..... **[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.

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

[Total: 4]

END OF QUESTION PAPER

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The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.