

Thursday 14 May 2015 – Morning

**GCSE TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A/SCIENCE 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	
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 (P).
- 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.



Joe
Burning coal in power stations affects the amount of pollution each year.



Tanya
It might not all be from power stations.

Both Joe and Tanya could be correct. Explain why.

.....

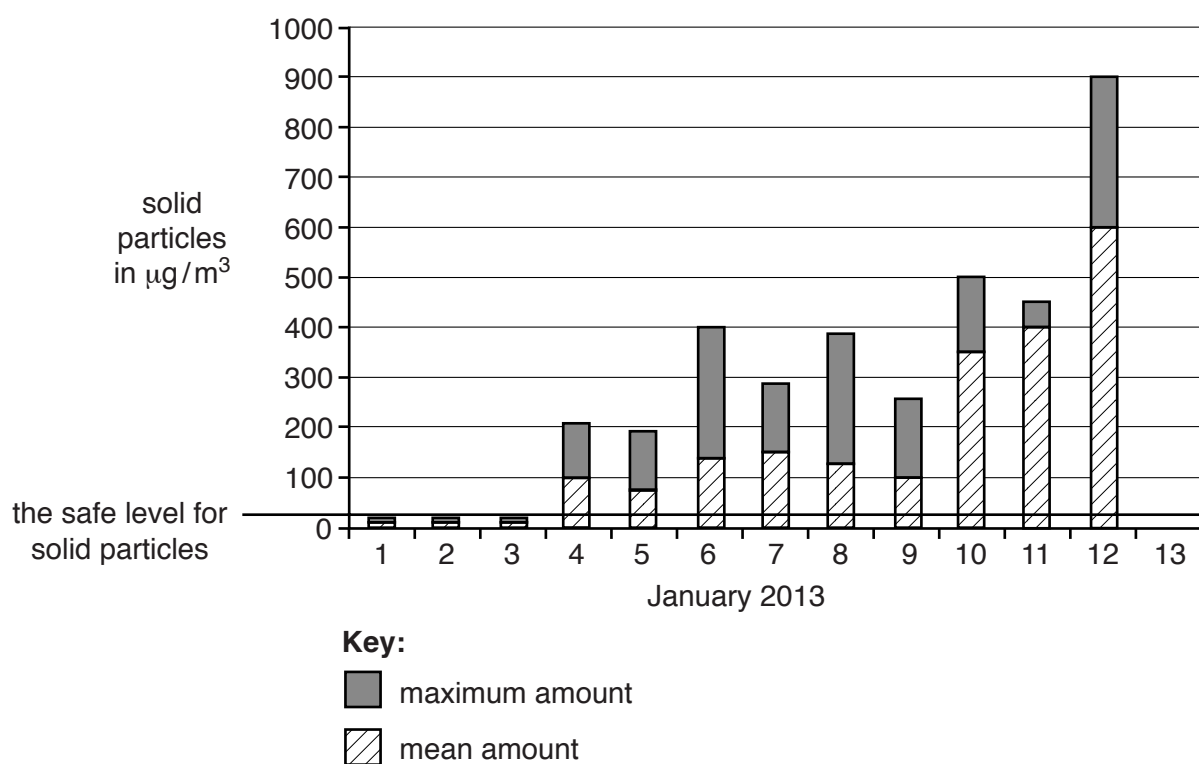
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..... [3]

(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 $25\mu\text{g}/\text{m}^3$.
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 6 th January was $400\mu\text{g}/\text{m}^3$.		
The mean on 9 th January was $100\mu\text{g}/\text{m}^3$.		
The highest value on any day was $600\mu\text{g}/\text{m}^3$.		
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 $\mu\text{g}/\text{m}^3$	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]

Turn over

- (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

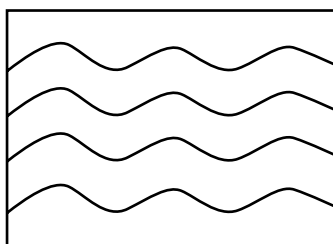
polymerisation

reduction

refining

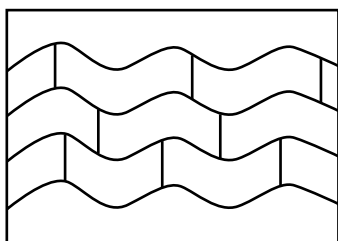
[1]

- (d) This diagram shows molecules of rubber.

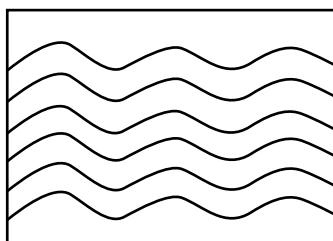


- (i) Which of the diagrams **A**, **B**, or **C** shows rubber that has been **cross-linked**?

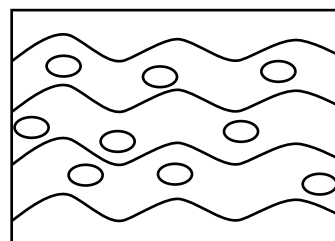
A



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]

	Kevlar	Nylon	Polyester	Polypropene
Tensile strength in N/mm²	210	70	70	65
Stiffness in MNm/kg	80	2	3	1
Density in g/cm³	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

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.

..... [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.

☐

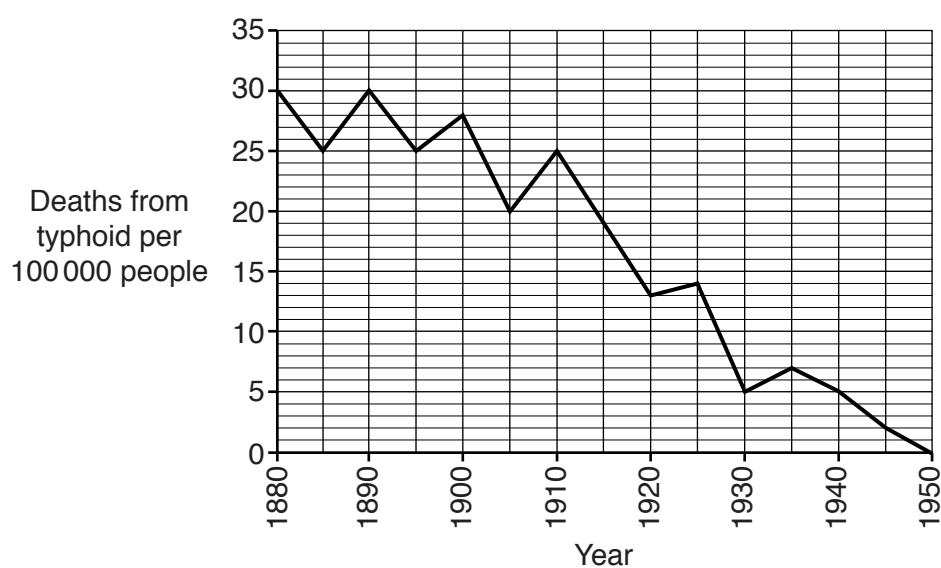
Making rope from plants uses local materials.

☐

[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?

.....

.....

.....

..... [2]

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.

..... [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.

Anna

The Food Standards Agency sets targets for salt in foods.



Ben

I know there are health problems with eating salt but food tastes awful without salt.



Carlos

The more salt you eat the higher your blood pressure.



Debbie

I don't want to take the chance of having heart disease.



(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?

.....

.....

.....

..... [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

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1	2	Key										3	4	5	6	7	0						
7 Li lithium 3		9 Be beryllium 4		relative atomic mass atomic symbol name atomic (proton) number										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						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						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						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										

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