

**Thursday 23 May 2013 – Morning**

**GCSE GATEWAY SCIENCE  
CHEMISTRY B**

**B741/01** Chemistry modules C1, C2, C3 (Foundation Tier)

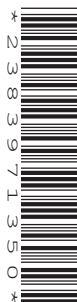
Candidates answer on the Question Paper.  
A calculator may be used for this paper.

**OCR supplied materials:**  
None

**Other materials required:**

- Pencil
- Ruler (cm/mm)

**Duration:** 1 hour 15 minutes  
**MODIFIED LANGUAGE**



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**

- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table can be found 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 **75**.
- This document consists of **28** pages. Any blank pages are indicated.

Answer **all** the questions.

### SECTION A – Module C1

- 1 Clean air is a mixture of gases.

The gases include nitrogen, oxygen and carbon dioxide.

The percentages of these gases do not change much.

This is because of **photosynthesis** and **respiration**.

- (a) Complete the sentences about photosynthesis and respiration.

Choose words from the list.

**carbon dioxide**

**decreases**

**increases**

**nitrogen**

**oxygen**

- (i) Photosynthesis increases the percentage of ..... in the air.

Photosynthesis decreases the percentage of ..... in the  
air. [1]

- (ii) Respiration ..... the percentage of carbon dioxide in the  
air. Respiration ..... the percentage of oxygen. [1]

- (b) **Carbon monoxide** is a pollutant sometimes found in air.

Write about a **source** of carbon monoxide pollution. Explain a **problem** caused by carbon monoxide.

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

(c)



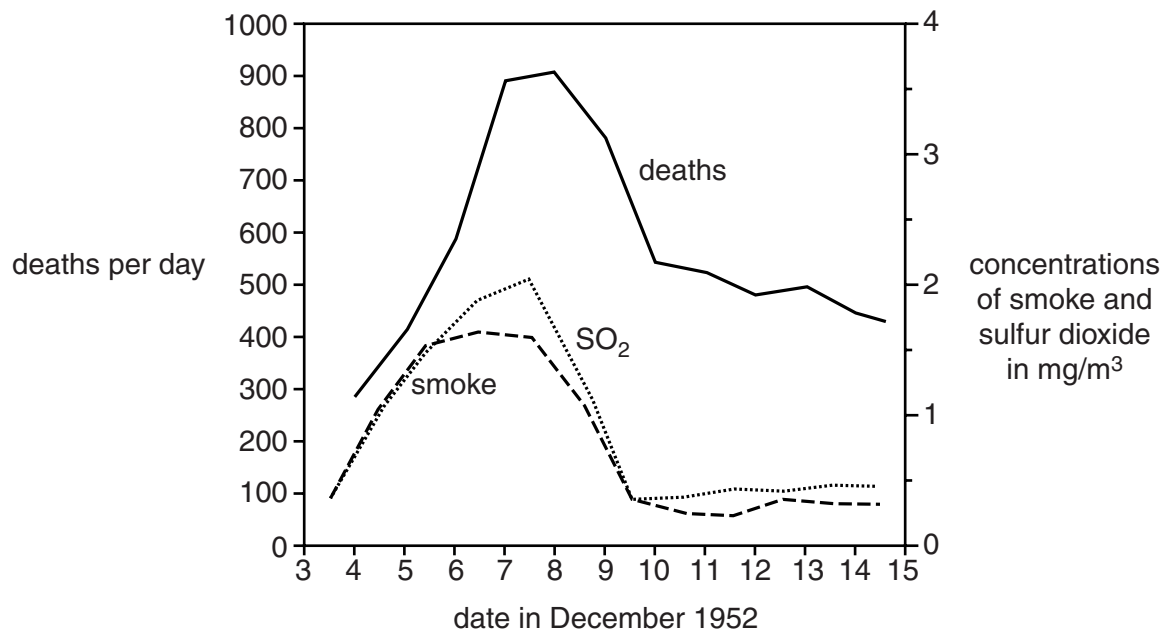
Air quality in the UK has improved over the last 60 years.

In December 1952, air pollution was so bad in London that sometimes people could not see their own feet.

Look at the graph.

It shows the number of deaths each day in London, between 3 December and 15 December 1952.

It also shows the concentrations of smoke and sulfur dioxide.



Describe the relationship between the number of deaths and the concentrations of smoke and sulfur dioxide.

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

(d) Catalytic converters are fitted to cars to help reduce air pollution.

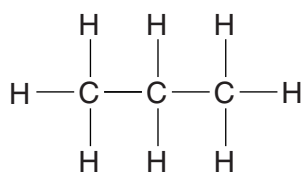
Write down a pollutant removed by catalytic converters.

..... [1]

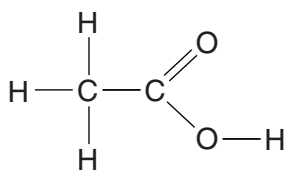
[Total: 7]

Turn over

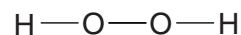
2 Look at the displayed formulas of some compounds.



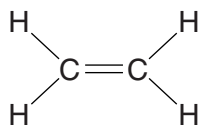
compound **A**



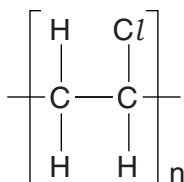
compound **B**



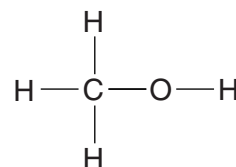
compound **C**



compound **D**



compound **E**



compound **F**

(a) Write down a compound that is a **hydrocarbon**.

Choose from **A, B, C, D, E** or **F**.

.....

[1]

(b) Look at the displayed formula for compound **B**.

How many **different elements** are in compound **B**?

.....

[1]

(c) Compound **E** is a polymer called poly(chloroethene).

Write down the name of the **monomer** that poly(chloroethene) is made from.

..... [1]

(d) Different polymers have different properties.

The uses of a polymer depend on its properties.

Look at the table. It compares the properties of three polymers, **A**, **B** and **C**.

	Density in g/cm <sup>3</sup>	Maximum useable temperature in °C	Strength in MPa (1 = weak, 10 = strong)	Relative flexibility
polymer <b>A</b>	0.92	85	1	flexible
polymer <b>B</b>	0.95	120	9	stiff
polymer <b>C</b>	0.89	25	2	stiff

Which polymer would you choose to make outdoor garden furniture?



polymer .....

Explain your choice.

.....

.....

.....

..... [3]

[Total: 6]

- 3 Chemicals called **esters** can be used to make perfumes or can be used as solvents.



- (a) Perfumes have a nice smell.

Perfumes must be insoluble in water so that they do not wash off easily.

Write down **two other** properties that perfumes must have.

.....

.....

..... [2]

- (b) Perfumes must be tested before they can be sold.

In the past, perfumes were tested on animals.

Testing on animals is now banned in the UK.

Write about different views that people have about testing perfumes on animals.

.....

.....

.....

..... [2]

- (c) Sarah investigates four different solvents.

She wants to know how well they remove a stain.

Look at her results.

Solvent	Percentage of stain removed	
	At 40°C	At 60°C
<b>A</b>	0%	35%
<b>B</b>	10%	60%
<b>C</b>	85%	100%
<b>D</b>	75%	95%

- (i) Which solvent is best at removing the stain?

answer.....

[1]

- (ii) Sarah decides that the solvents work better at a higher temperature.

How can you tell from Sarah's results?

..... [1]

[Total: 6]

It shows some information about fractions obtained from crude oil.

Fraction	Boiling temperature in °C
bitumen	above 350
LPG	less than 40
fuel oil	300 – 350
heating oil	250 – 300
petrol	40 – 200
paraffin	200 – 250



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

..... [6]

**[Total: 6]**



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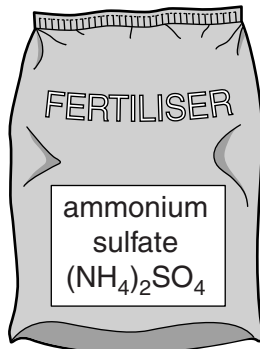
**Question 5 begins on page 10**

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## SECTION B – Module C2

5 This question is about fertilisers.

(a) Ammonium sulfate is used as a fertiliser.



The formula for ammonium sulfate is  $(\text{NH}_4)_2\text{SO}_4$ .

(i) Write down how many **different elements** there are in ammonium sulfate.

answer ..... [1]

(ii) Write down how many **atoms** there are in this formula.

answer ..... [1]

(b) Chloe makes some ammonium sulfate.

The alkali she uses is ammonia solution.

Which **acid** does she use?

..... [1]

(c) Write about one **benefit** and one **problem** of using fertilisers.

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

[Total: 5]

	Density in g/cm <sup>3</sup>	Relative electrical conductivity (0 = low, 100 = high)	Relative strength (0 = weak, 1000 = very strong)	Corrosion in moist air	Cost per tonne in £
Aluminium	2.7	40	300	does not corrode	770
Copper	8.9	64	400	corrodes slowly	5900
Iron	7.9	11	600	corrodes	200

A black and white photograph showing a railway track with overhead power lines. The sky is filled with dramatic, dark clouds. In the foreground, there is a grassy field with a fence and some trees in the distance. The power lines are supported by tall poles, and the tracks curve slightly to the right.



..... [6]

**Turn over**

7 (a) Sam makes some copper.

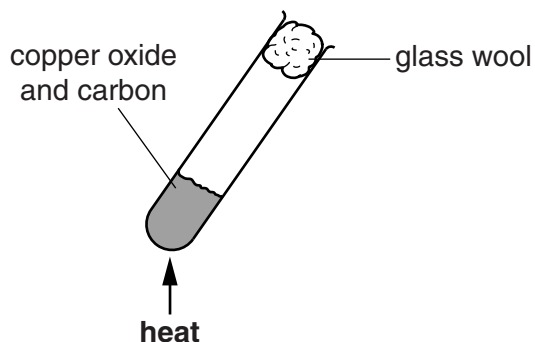
(i) Sam heats copper oxide,  $\text{CuO}$ , with carbon,  $\text{C}$ .

Copper,  $\text{Cu}$ , and carbon dioxide,  $\text{CO}_2$ , are made.

Write a **balanced symbol** equation for this reaction.

..... [2]

(ii) Look at the diagram. It shows the apparatus he uses.



Sam measures the mass of the test tube and its contents before and after heating.

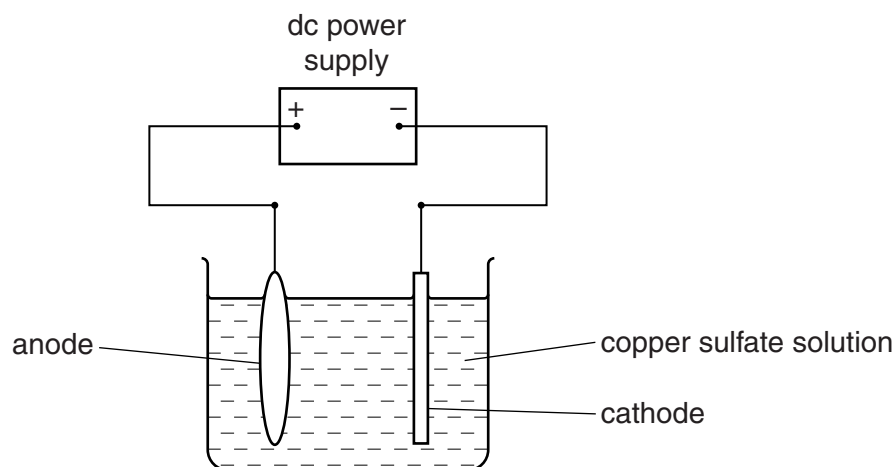
The mass of the test tube and its contents **decreases**.

Suggest why.

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

(b) The copper Sam makes is impure.

Look at the diagram. It shows the apparatus he uses to purify the copper.



What is the name of the process used to purify copper?

Choose from the list.

**crystallisation**

**electrolysis**

**eutrophication**

**neutralisation**

**thermal decomposition**

answer ..... [1]

(c) **Recycling** copper is cheaper than extracting copper from its ore.

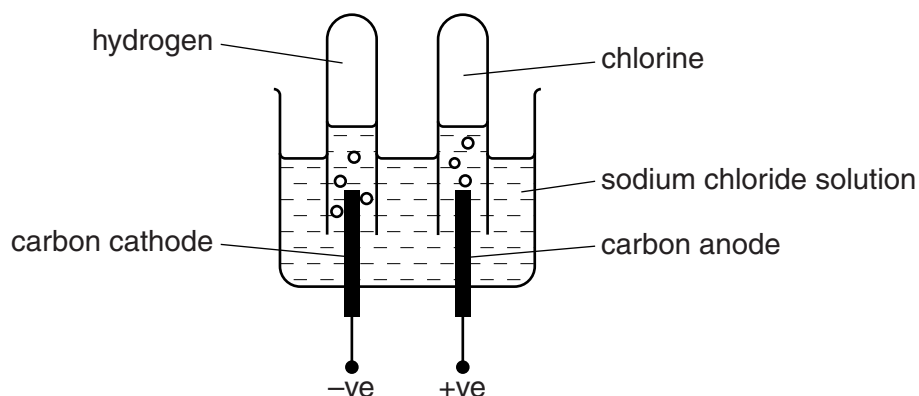
Explain why.

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

**[Total: 6]**

- 8 Molly investigates passing an electric current through sodium chloride solution.

Look at the apparatus she uses.



- (a) Look at the list. It shows the particles in sodium chloride solution.



Which particle is a **molecule**?

Choose from the list.

answer .....

[1]

- (b) Chlorine is made in this experiment.

What is the **test** for chlorine gas?

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

[Total: 3]

- 9 Ammonia is made from nitrogen and hydrogen in the Haber process.

Look at the equation for this reaction.

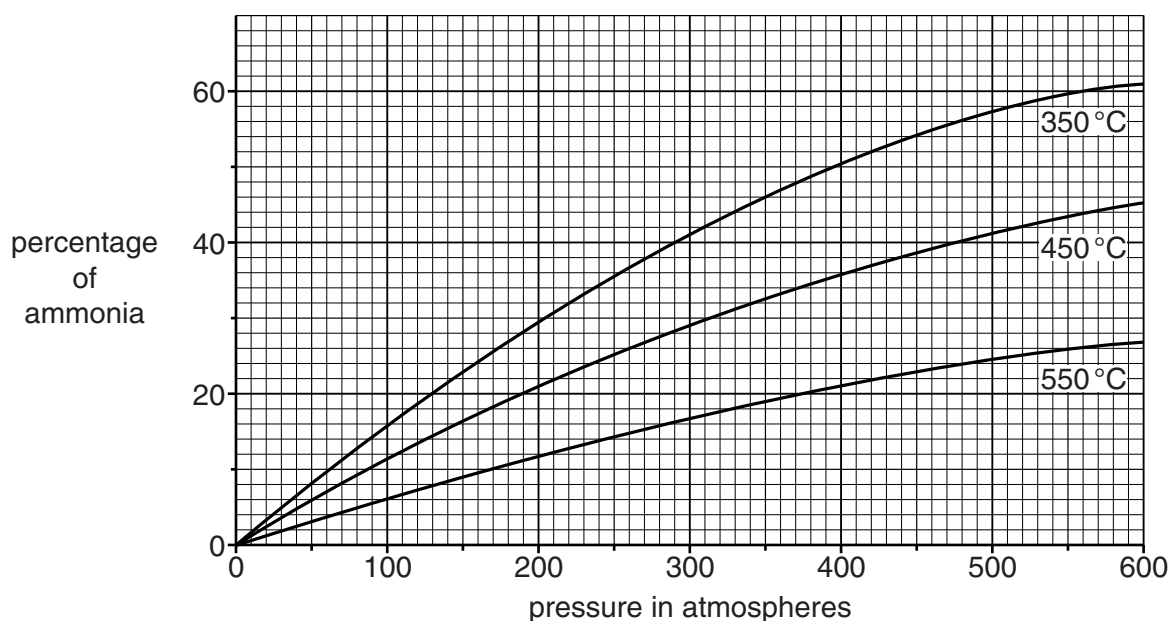


- (a) What does the symbol  $\rightleftharpoons$  mean?

..... [1]

- (b) The percentage of ammonia changes as the temperature and pressure change.

Look at the graph.



Look at the graph for **350°C**.

What is the percentage of ammonia at **400 atmospheres**?

answer ..... %

[1]

- (c) There are many costs in making ammonia.

One of these is the cost of energy (gas and electricity).

Write about some of the **other** costs of making ammonia.

.....

.....

.....

..... [3]

[Total: 5]

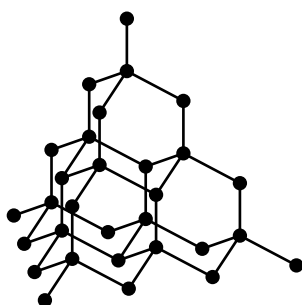
**16**  
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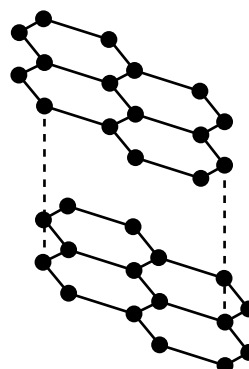


## SECTION C – Module C3

10 This question is about diamond and graphite.



**diamond**



**graphite**

- (a) Diamond and graphite are made of the same element.

Which element?

..... [1]

- (b) One property of diamond is that it is very hard.

Diamond is used to make cutting tools.

Write about some other properties of diamond.

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

**[Total: 4]**

**11** Hilary investigates the reaction between magnesium and hydrochloric acid.

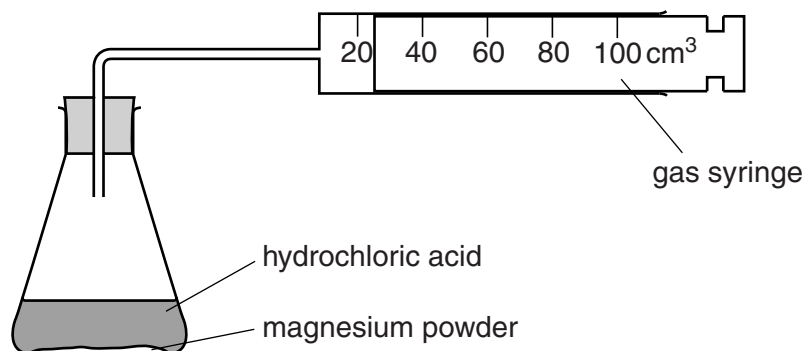
Magnesium chloride and hydrogen are made.

**(a)** Write down the **word** equation for this reaction.

..... [1]

**(b)** Look at the diagram.

It shows the apparatus she uses.



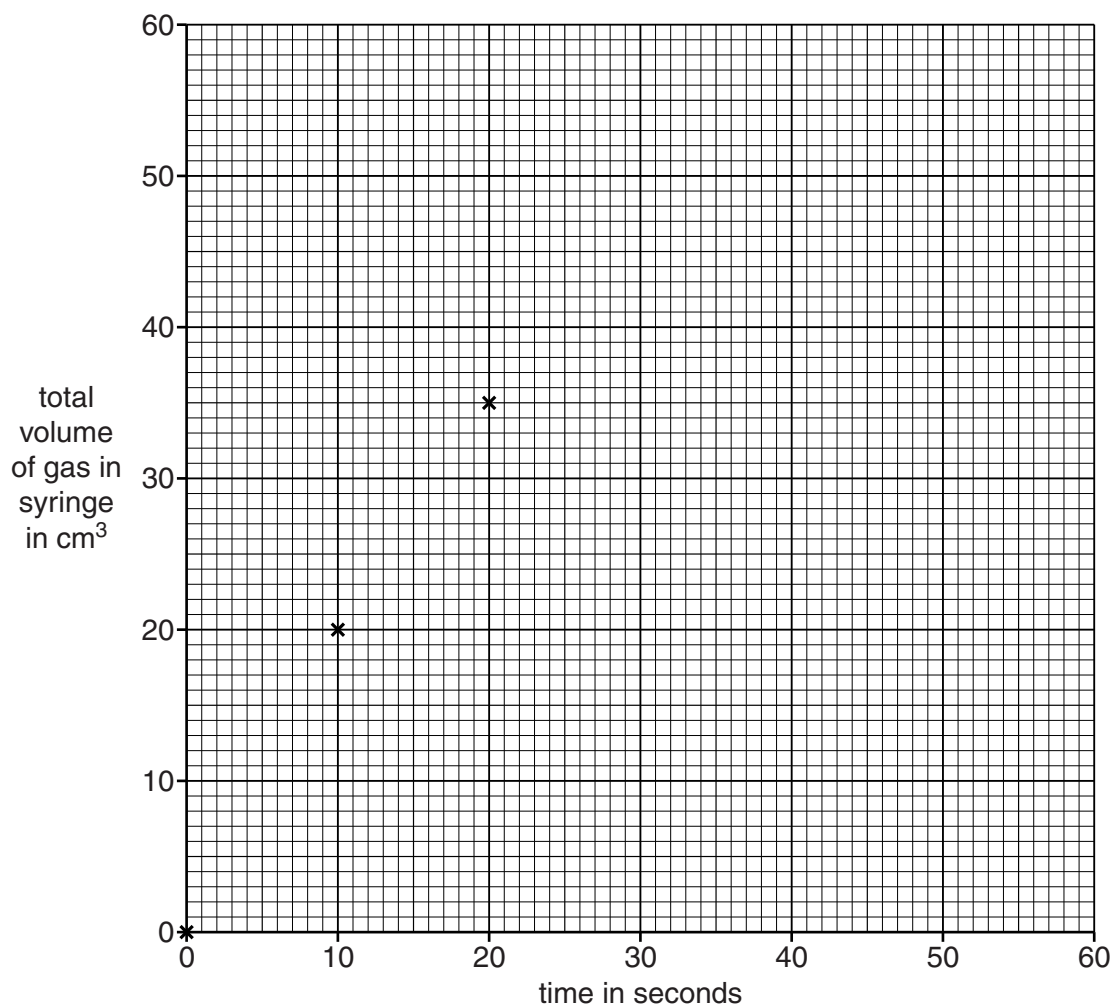
Hilary measures the total volume of gas in the syringe every 10 seconds.

Look at Hilary's results.

Time in seconds	Total volume of gas in syringe in cm <sup>3</sup>
0	0
10	20
20	35
30	45
40	49
50	50
60	50

- (i) **Plot** these results on the graph and draw the best line through the points.

The first three points have been plotted for you.



[2]

- (ii) Look at the results.

The reaction stops after **50 seconds**. No more gas is given off.

Explain why.

..... [1]

- (c) Hilary repeats the experiment.

This time she uses **lumps** of magnesium.

The reaction is **slower**.

Explain, using the reacting particle model, why the reaction is slower.

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

[Total: 6]  
 Turn over

**20**  
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**12** Magnesium sulfate is used as a fertiliser.

It is also used as a medicine.

**(a)** Magnesium sulfate can be made in industry by a **batch** or a **continuous** process.

Write about the differences between a batch process and a continuous process.

.....

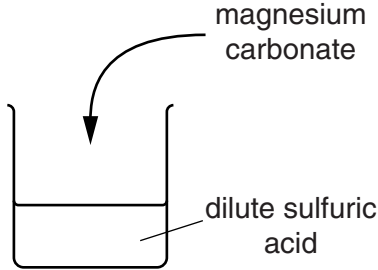
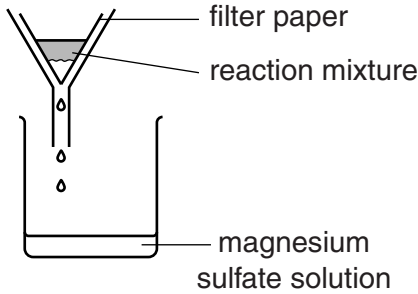
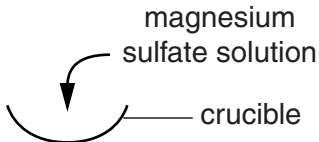
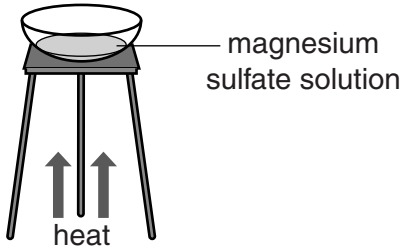
.....

..... [2]

**Question 12 continues on page 22**

(b) Jim makes some magnesium sulfate.

This is the method he uses.

<p><b>Step 1</b></p>  <p>magnesium carbonate</p> <p>dilute sulfuric acid</p>	<p>Jim adds magnesium carbonate to dilute sulfuric acid. He stops adding magnesium carbonate when the mixture stops bubbling.</p>
<p><b>Step 2</b></p>  <p>filter paper</p> <p>reaction mixture</p> <p>magnesium sulfate solution</p>	<p>Jim filters the reaction mixture to remove excess magnesium carbonate.</p>
<p><b>Step 3</b></p>  <p>magnesium sulfate solution</p> <p>crucible</p>	<p>Jim pours the magnesium sulfate solution into a crucible.</p>
<p><b>Step 4</b></p>  <p>magnesium sulfate solution</p> <p>heat</p>	<p>Jim evaporates half of the magnesium sulfate solution. He then leaves the concentrated solution to cool. Crystals are made in the solution.</p>

He actually makes **3 g.**

Calculate the **percentage yield** for this reaction. Suggest **reasons** why the yield is **less** than 100%.



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

..... [6

**[Total: 8]**

**13** This question is about energy changes during chemical reactions.

**(a)** Cold packs are used to treat sports injuries.

The cold pack **reduces** the temperature of the injured part of the body.



A chemical reaction happens when the cold pack is squeezed.

Look at the table.

It shows the temperature changes for four different reactions, **A**, **B**, **C** and **D**.

Reaction	Start temperature in °C	Final temperature in °C	Temperature change in °C
<b>A</b>	18	12	−6
<b>B</b>	18	18	0
<b>C</b>	18	25	+7
<b>D</b>	18	23	+5

Which reaction would be the best one for use in the cold pack?

Choose from **A**, **B**, **C** or **D**.

answer .....

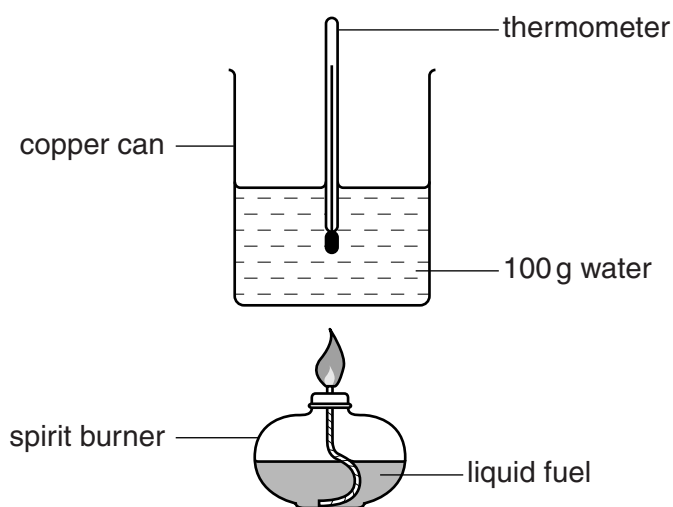
[1]



(b) Aimee and Luke investigate four liquid fuels.

They burn 1.0 g of each liquid fuel.

Look at the diagram. It shows the apparatus they use.



Look at the table. It shows their results.

Liquid fuel	Temperature at start in °C	Temperature at end in °C
ethanol	20	40
methyated spirits	21	39
paraffin	22	45
propanol	22	44

(i) Which liquid fuel transfers the **least** energy?

answer .....

[1]

(ii) Calculate the energy transferred by **ethanol**.

**energy transferred = mass × specific heat capacity × temperature change**

The specific heat capacity of water is 4.2 J/g°C

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

answer ..... J

[2]

[Total: 4]

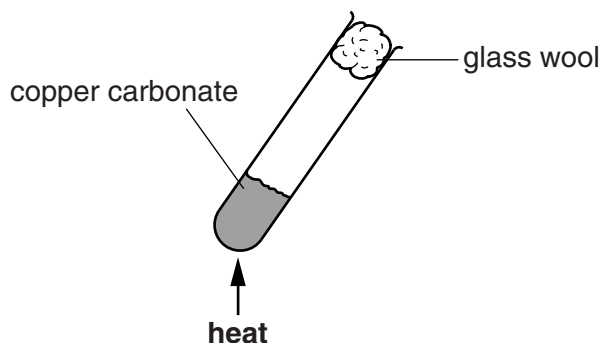
14 John and Sue investigate the decomposition of copper carbonate.

- (a) Copper carbonate,  $\text{CuCO}_3$ , breaks down into copper oxide,  $\text{CuO}$ , and carbon dioxide,  $\text{CO}_2$ .

Write the **balanced symbol** equation for this reaction.

..... [1]

- (b) Look at the diagram. It shows the apparatus they use.



They measure the contents of the test tube before and after heating.

Look at their results.

	Mass in g
mass of contents before heating	12.40
mass of contents after heating	8.00

- (i) Calculate the mass of **carbon dioxide** made.

.....

answer ..... g [1]

- (ii) John and Sue repeat the experiment.

This time they use **24.80 g** of copper carbonate.

Calculate the mass of **carbon dioxide** they make this time.

answer ..... g [1]

[Total: 3]

**END OF QUESTION PAPER**

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# The Periodic Table of the Elements

28

1	2	3					4	5	6	7	0						
		<div>1 H hydrogen 1</div>															
<div>Key</div>																	
		<div>relative atomic mass atomic symbol name atomic (proton) number</div>															
7 Li lithium 3	9 Be beryllium 4																
23 Na sodium 11	24 Mg magnesium 12																
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						

\* 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.