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F

Thursday 23 May 2013 – Morning

GCSE GATEWAY SCIENCE
CHEMISTRY B

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

B72231061 3

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

B741 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

- 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 vary 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 and decreases the percentage of ..... . **[1]**

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

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

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

.....

.....

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

(c)

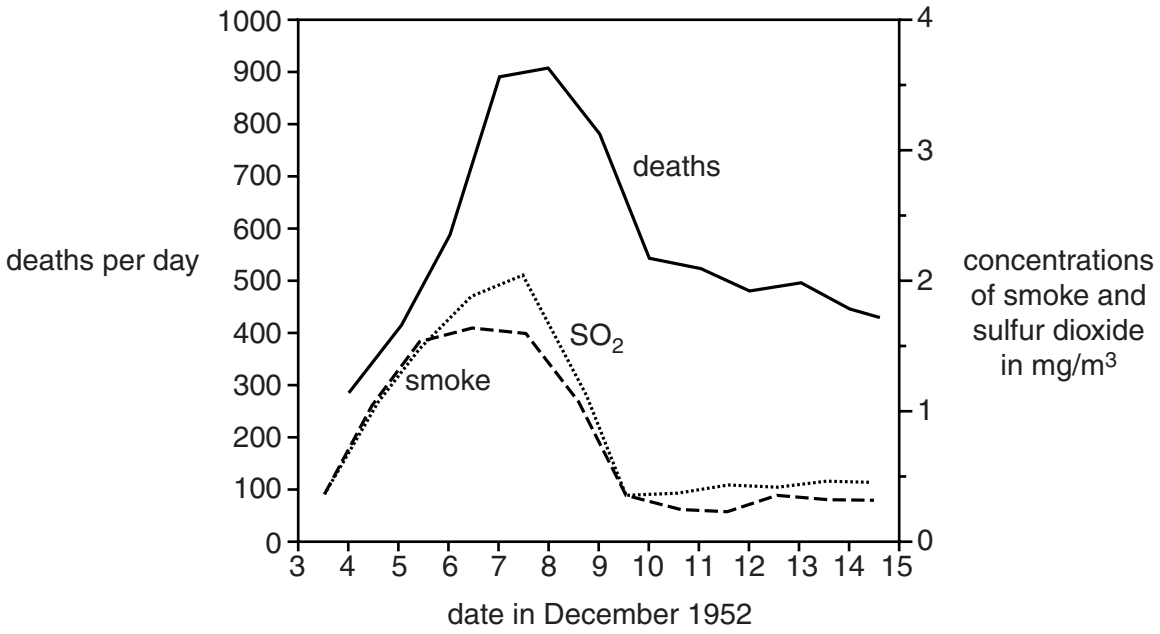
Air quality in the UK has improved over the last 60 years.

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]**

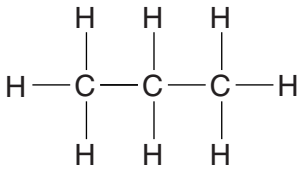
(d) Catalytic converters are fitted to cars to help reduce air pollution.

Write down a pollutant removed by catalytic converters.

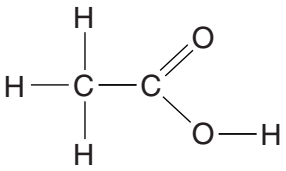
..... **[1]**

[Total: 7]

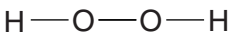
2 Look at the displayed formulas of some compounds.



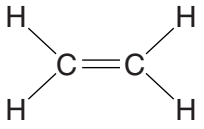
compound **A**



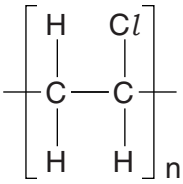
compound **B**



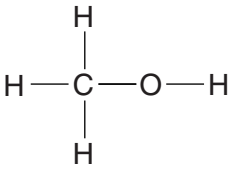
compound **C**



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^3	**Maximum useable temperature in °C**	**Strength in MPa (1 = weak, 10 = strong)**	**Relative flexibility**
polymer **A**	0.92	85	1	flexible
polymer **B**	0.95	120	9	stiff
polymer **C**	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
A	0%	35%
B	10%	60%
C	85%	100%
D	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]

4 Fractional distillation separates crude oil into useful fractions.

Look at the table.

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

Write about how fractional distillation separates crude oil into fractions and list the fractions in the position, from top to bottom, that they 'exit' the fractionating column.

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

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

[Total: 6]

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Question 5 begins on page 10

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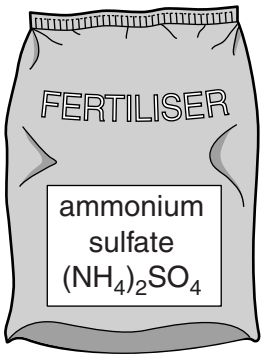
SECTION B – Module C2

5 This question is about fertilisers.

(a) Ammonium sulfate is used as a fertiliser.



The formula for ammonium sulfate is $(NH_4)_2SO_4$.

(i) Write down the number of **different elements** in ammonium sulfate.

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

(ii) Write down the number of **atoms** 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]

6 This question is about metals.

Look at the table. It shows some properties of three metals.

	Density in g/cm^3	**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

Look at the picture. It shows overhead power cables used by electric trains.

Suggest what **properties** are needed by a metal used to make the overhead power cables.

Which metal in the table would you use and why?

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

.....

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

[Total: 6]

7 **(a)** Sam makes some copper.

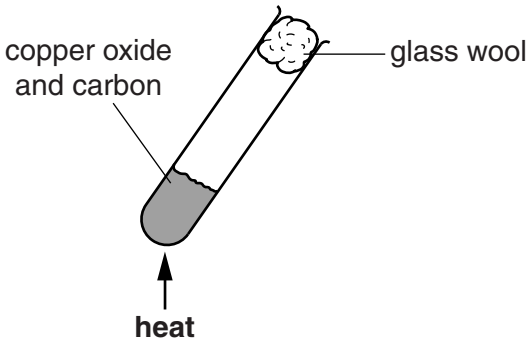
(i) Sam heats copper oxide, CuO, with carbon, C.

Copper, Cu, and carbon dioxide, 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**.

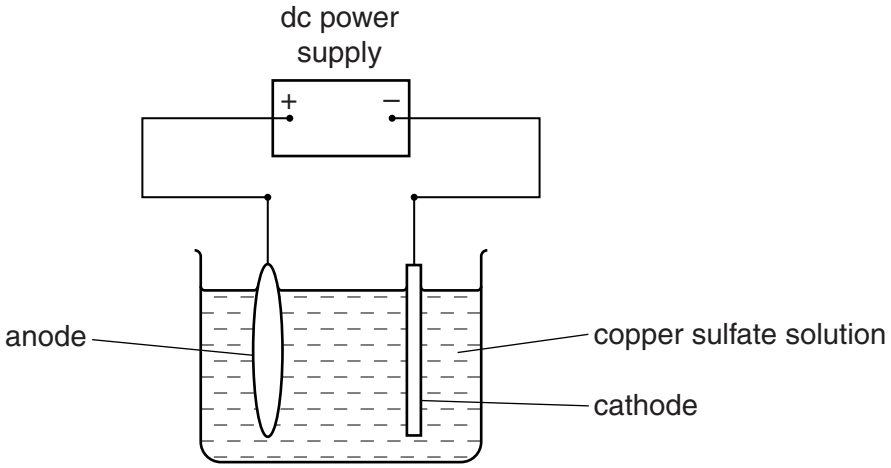
Suggest why.

.....

..... **[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.

.....

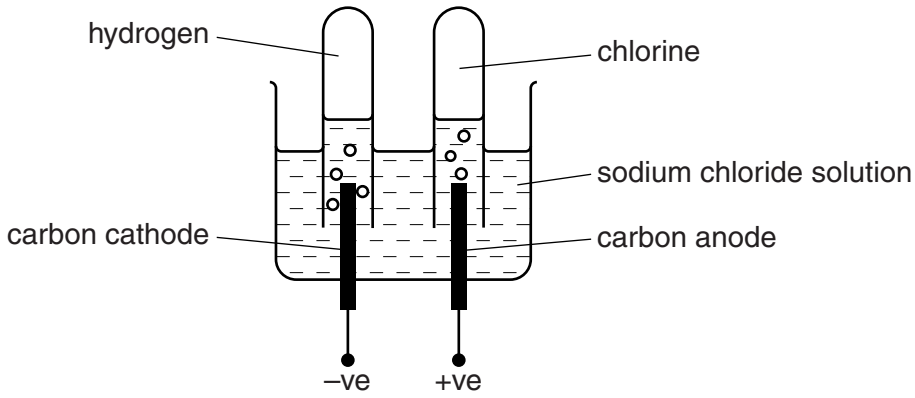
.....

..... **[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.

H^+

H_2O

OH^-

Cl^-

Na^+

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.

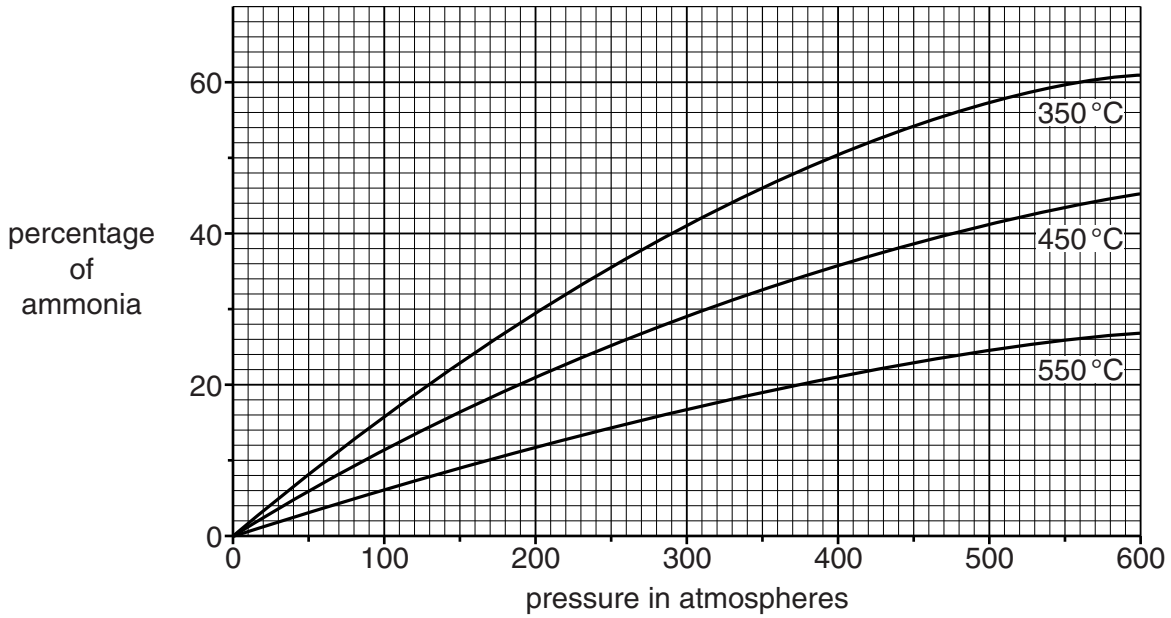
$$\text{nitrogen} + \text{hydrogen} \rightleftharpoons \text{ammonia}$$

(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.

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.....

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

[Total: 5]

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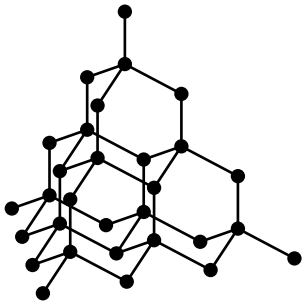
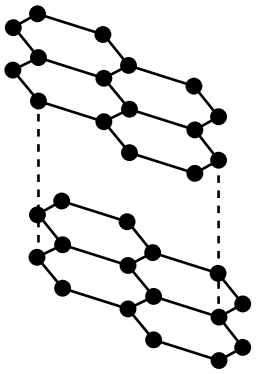
SECTION C – Module C3

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.

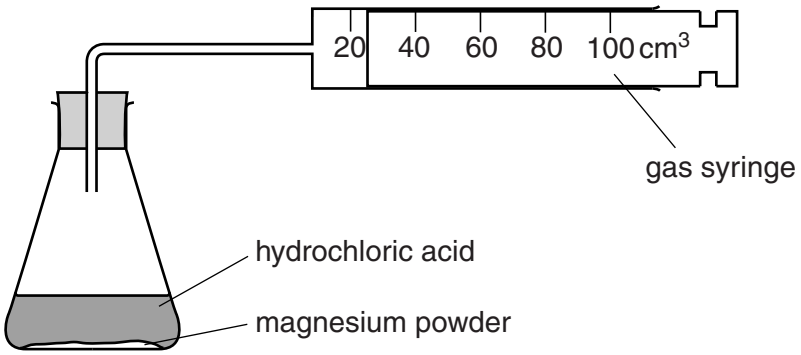
Magnesium chloride and hydrogen are made.

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

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

(b) Look at the diagram.

It shows the apparatus she uses.



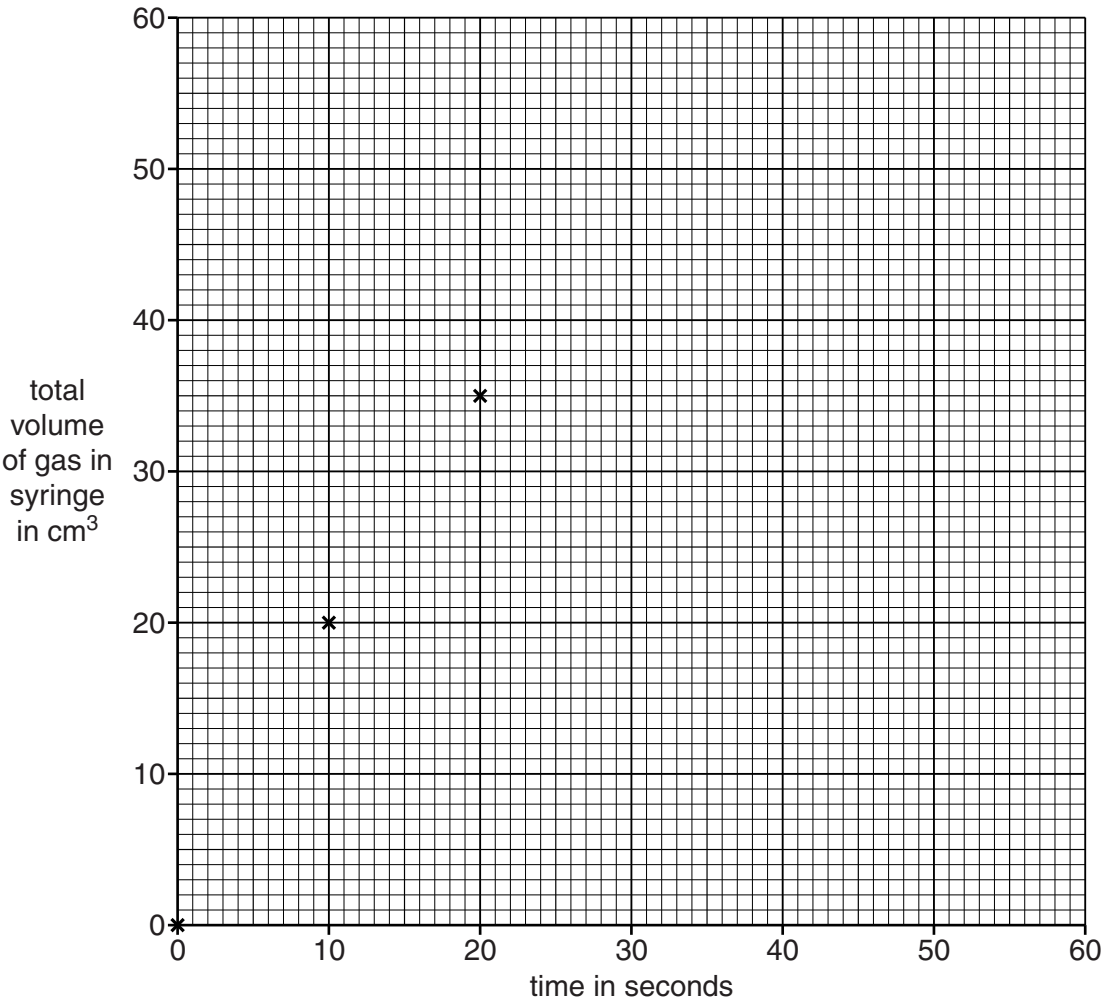
Hilary measures the total volume of gas in the syringe every 10 seconds.

Look at Hilary's results.

Time in seconds	Total volume of gas in syringe in cm^3
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]

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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.

.....

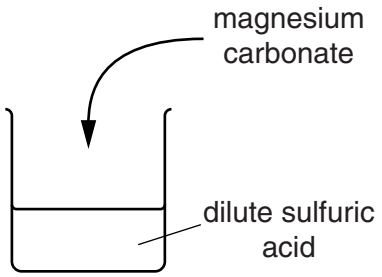
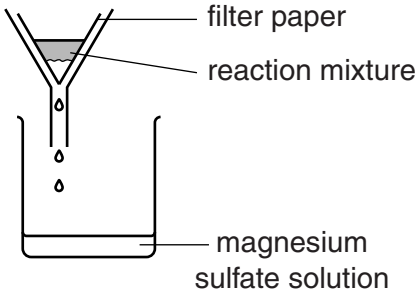
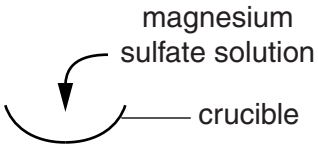
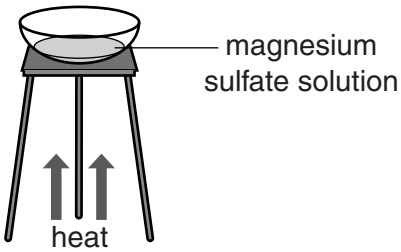
.....

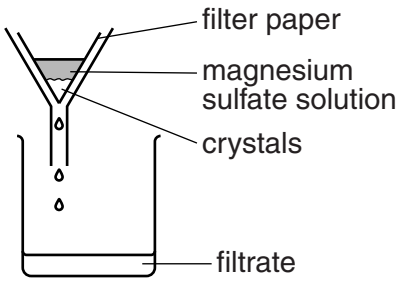
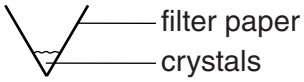
..... **[2]**

Question 12 continues on page 22

(b) Jim makes some magnesium sulfate.

This is the method he uses.

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

Step **5**  	Jim filters off the crystals.
Step **6**  	Jim dries the crystals of magnesium sulfate.

Jim predicts he should make **4 g** of magnesium sulfate.

He actually makes **3 g**.

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

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

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..... **[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
A	18	12	–6
B	18	18	0
C	18	25	+7
D	18	23	+5

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

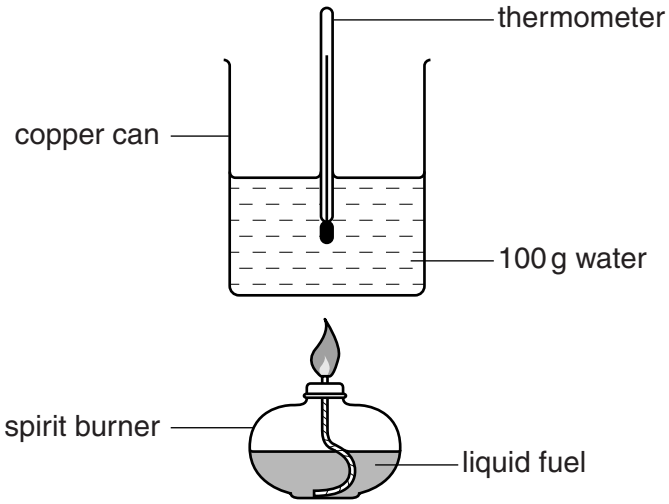
Choose from **A**, **B**, **C** or **D**.

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
methylated 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]

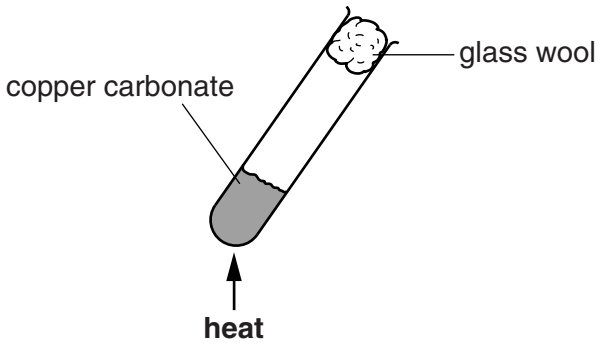
14 John and Sue investigate the decomposition of copper carbonate.

(a) Copper carbonate, $CuCO_3$, breaks down into copper oxide, CuO, and carbon dioxide, 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

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.