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Thursday 24 May 2012 – Morning

GCSE GATEWAY SCIENCE
CHEMISTRY B

B741/02 Chemistry modules C1, C2, C3 (Higher Tier)

B722320612

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 02

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

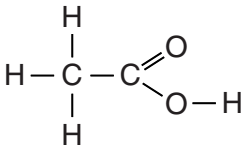
- Your quality of written communication is assessed in questions marked with a pencil (✎).
- The Periodic Table can be found on the back page.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **75**.
- This document consists of **24** pages. Any blank pages are indicated.

Answer **all** the questions.

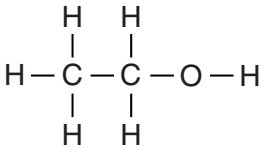
Section A – Module C1

1 This question is about carbon compounds.

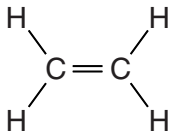
Look at the displayed formulas of some compounds.



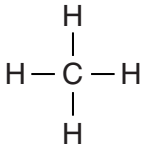
ethanoic acid



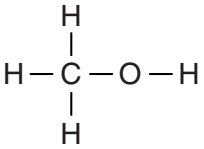
ethanol



ethene



methane



methanol

(a) Methane is an **alkane**.

Explain how you can tell from the displayed formula.

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

(b) Write down the name of a compound that is an **unsaturated** hydrocarbon.

Choose from the compounds shown.

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

(c) Write down the **molecular formula** of ethanoic acid.

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

(d) Ethene reacts with bromine, Br_2, to form dibromoethane, $C_2H_4Br_2$.

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

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

[Total: 4]

2 John and Sue are building a new house.

They want to choose the best fuel for their house.

They find out some information about four possible fuels.

fuel	is it easy to use?	annual cost to heat the house in £	is it available to this house?
coal	no	750	yes
LPG	yes	972	yes
natural gas	yes	720	no
oil	yes	750	yes

(a) Which fuel should John and Sue choose?

Explain your choice.

.....

.....

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

(b) LPG contains propane gas, C_3H_8.

Write a **balanced symbol** equation for the complete combustion of propane in oxygen, O_2.

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

[Total: 4]

3 This question is about paint and pigments.

(a) Emulsion paint is one type of paint.

Describe how emulsion paint dries.

.....

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

(b) Look at the table. It gives some information about pigments.

pigment	colour at 20 °C	colour at 100 °C	effect of light
A	blue	blue	colour fades
B	green	green	gives off light in the dark
C	blue	red	no change
D	yellow	yellow	no change

Which pigment would be useful on a kettle of boiling water?

.....

Explain your choice.

.....

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

(c) Paint is a **colloid**.

A colloid contains pigment particles mixed with particles of a liquid.

Explain why the pigment particles and liquid particles do not separate.

.....

.....

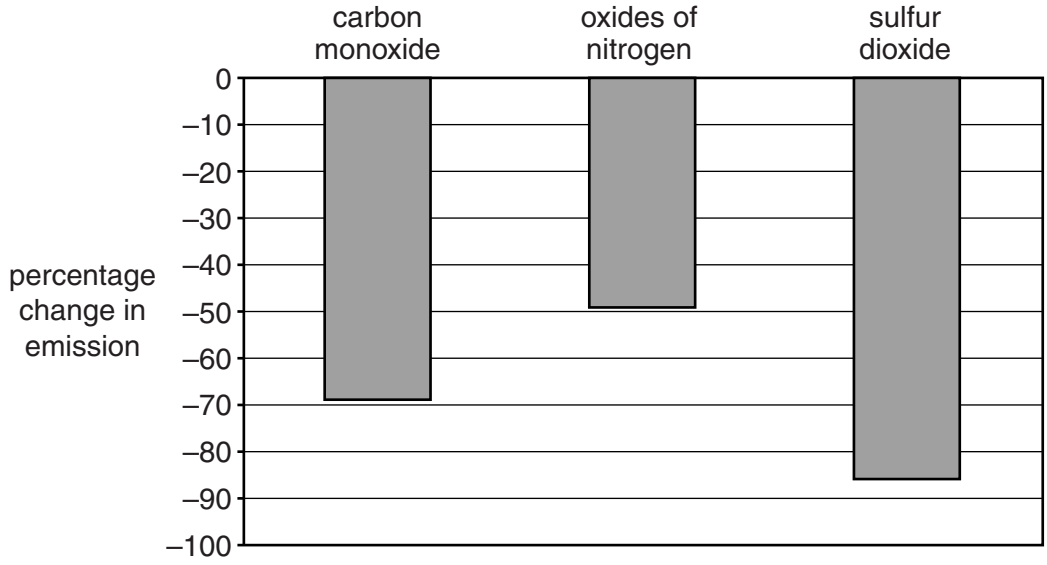
..... **[2]**

[Total: 5]

4 This question is about air pollutants.

Look at the graph.

It shows how the levels of some pollutants found in UK cities have changed from 1990 to 2008.



The levels of these pollutants have decreased.

Explain, using a chemical equation, possible reasons for these changes.

Explain why it is important that air pollution is controlled.

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

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

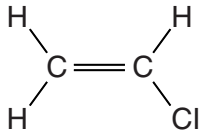
[Total: 6]

5 This question is about polymers.

(a) Poly(chloroethene) is a polymer.

Poly(chloroethene) is made from a monomer called chloroethene.

Look at the displayed formula of chloroethene.



Draw the displayed formula of poly(chloroethene).

[1]

(b) The plastic made from the polymer poly(chloroethene) can be used to make water pipes.

One property of poly(chloroethene) is that it is easy to shape.

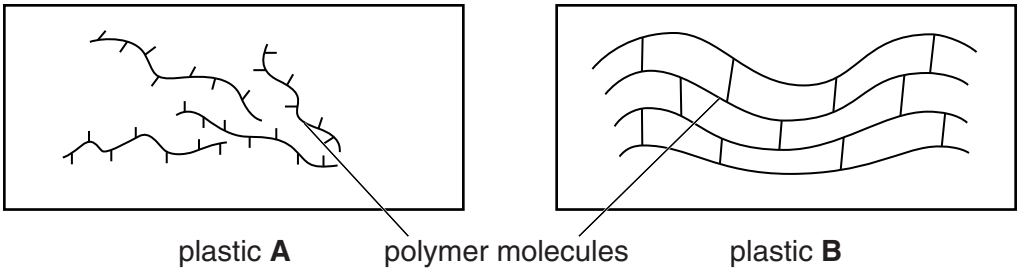
Write about **other** properties of poly(chloroethene) that make it suitable for making water pipes.

.....

.....

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

(c) Look at the diagrams. They show the structures of two plastics.



(i) Plastic **A** can be stretched easily.

Explain why.

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.....

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

(ii) Plastic **B** has a high melting point.

Explain why.

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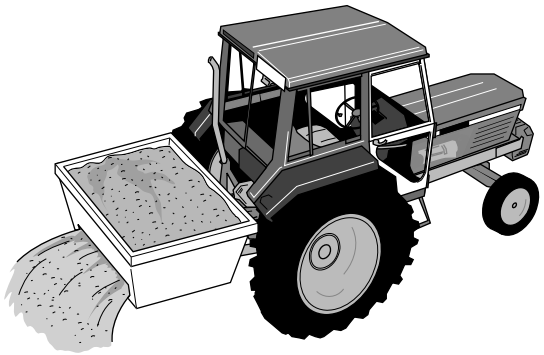
..... **[1]**

[Total: 6]

Section B – Module C2

6 This question is about fertilisers.



Farmers use fertilisers to make crops grow bigger and faster. This increases crop yield.

(a) Explain how the use of fertilisers increases crop yield.

.....

.....

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

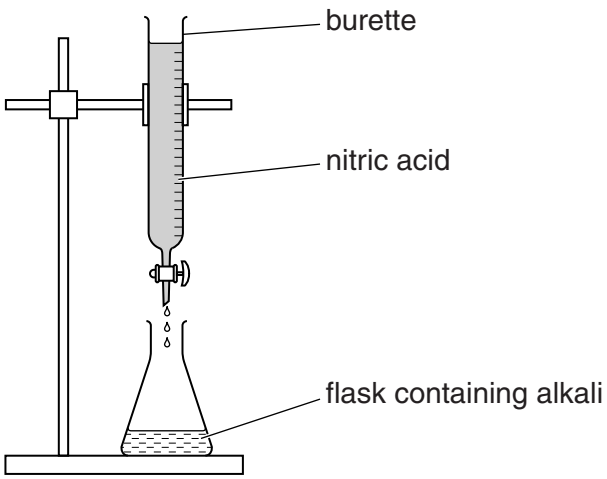
(b) Ammonium phosphate, $(NH_4)_3PO_4$, is used as a fertiliser.

Write down the total number of **atoms** in the formula $(NH_4)_3PO_4$.

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

(c) Chloe makes some potassium nitrate by neutralising an alkali with nitric acid.

Look at the diagram. It shows the apparatus she uses.



(i) Write down the **name** of the **alkali** Chloe uses to make potassium nitrate.

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

(ii) Chloe adds nitric acid to the flask until the solution is **neutral**.

Explain, using the ions involved, why the alkali is neutralised by nitric acid.

.....

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

[Total: 5]

7 Look at the photograph of an erupting volcano.

(a) There were serious volcanic eruptions in many countries in 2010.

Many people's homes were destroyed.

Suggest why geologists did not predict all these eruptions.

.....

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

(b) In 1914, Wegener used evidence to propose his 'continental drift theory'.

In the late 1950s, this became part of a new theory called plate tectonics.

Today, the theory of plate tectonics is widely accepted by scientists.

Explain why.

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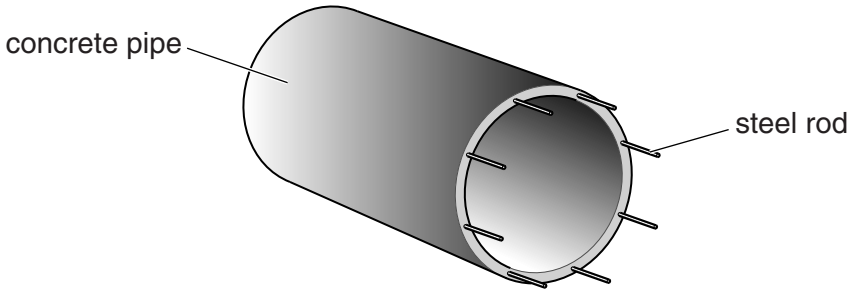
..... **[2]**

[Total: 3]

8 Concrete is a building material made from cement.

Look at the picture. It shows a pipe made of reinforced concrete.



Look at the table. It shows some properties of concrete and steel.

	concrete	**steel**
density in g/cm^3	2.3	7.9
relative strength	40	210
flexibility	not flexible	has some flexibility
relative hardness	very hard	very hard

Explain, using information in the table, why reinforced concrete is a composite material and a better construction material than non-reinforced concrete.

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

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

[Total: 6]

9 This question is about industrial processes.

(a) An industrial process makes sulfur trioxide.

Sulfur dioxide, SO_2, reacts with oxygen, O_2.

Sulfur trioxide, SO_3, is made.

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

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

(b) A second industrial process makes an acid.

Look at the table. It shows the percentage yield of the acid made at different temperatures and pressures.

pressure in atmospheres	percentage yield at 200 °C	percentage yield at 400 °C	percentage yield at 600 °C
100	80%	22%	8%
200	92%	40%	14%
300	95%	56%	18%
400	96%	67%	22%

(i) How does **increasing** the **temperature** change the percentage yield?

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

(ii) A temperature of 400 °C, a pressure of 200 atmospheres and a catalyst are used to make the acid.

These conditions do not give the highest percentage yield.

Suggest why these conditions are chosen.

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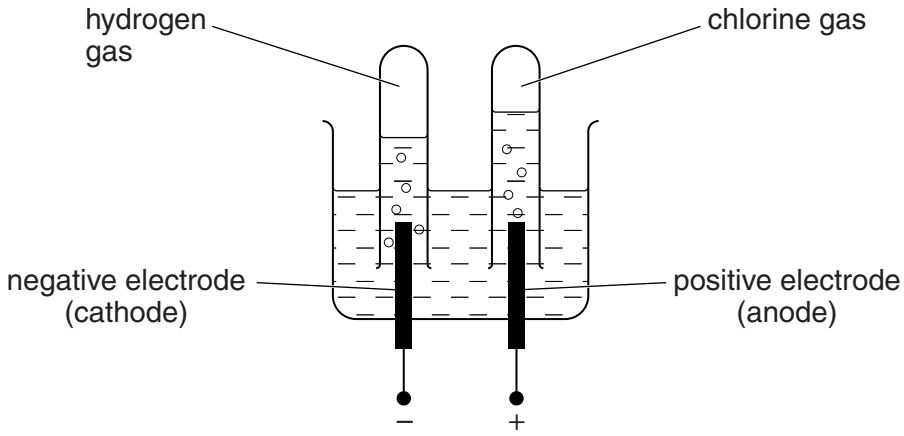
..... **[3]**

[Total: 6]

10 Chlorine is made by the electrolysis of **concentrated** sodium chloride solution.

Sarah investigates this electrolysis.

Look at the apparatus she uses.



Sodium chloride solution contains Na^+, OH^-, Cl^- and H^+ ions.

(a) At the positive electrode, chloride ions lose electrons to make chlorine gas, Cl_2.

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

Use e^- to represent an electron.

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

(b) Look at the list of ions in sodium chloride solution.

Two ions do not react at the electrodes.

Write down the name of the solution these ions make.

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

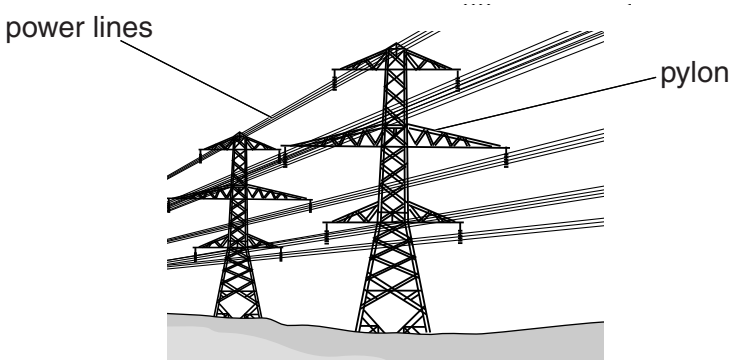
[Total: 3]

11 This question is about metals.

Look at the table. It shows the properties of two metals.

	aluminium	**iron**
density in g/cm^3	2.7	7.9
relative electrical conductivity	40	11
relative strength	70	210
cost per tonne in £	1350	400

Look at the picture of some power lines.



The power company makes the power lines from iron surrounded by aluminium.

Explain why the power company makes power lines from iron **and** aluminium.

Use information in the table.

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

[Total: 2]

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Question 12 begins on page 16.

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Section C – Module C3

12 Antacid tablets are used to stop indigestion.

Antacid tablets contain calcium carbonate, $CaCO_3$.

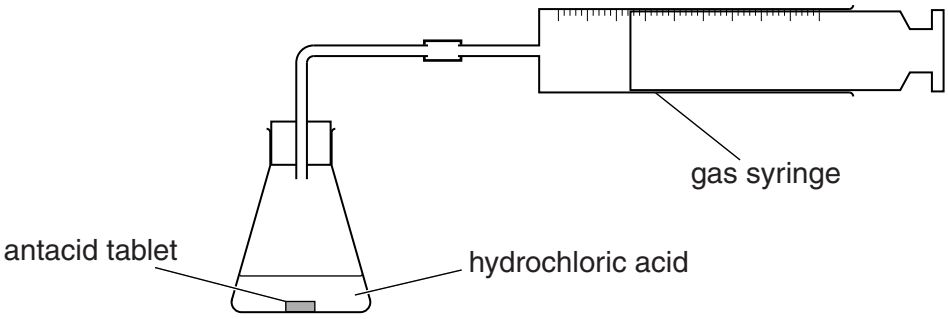
Jennie and Gary investigate the reaction of antacid tablets with hydrochloric acid.

Calcium chloride, $CaCl_2$, water and carbon dioxide are made.

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

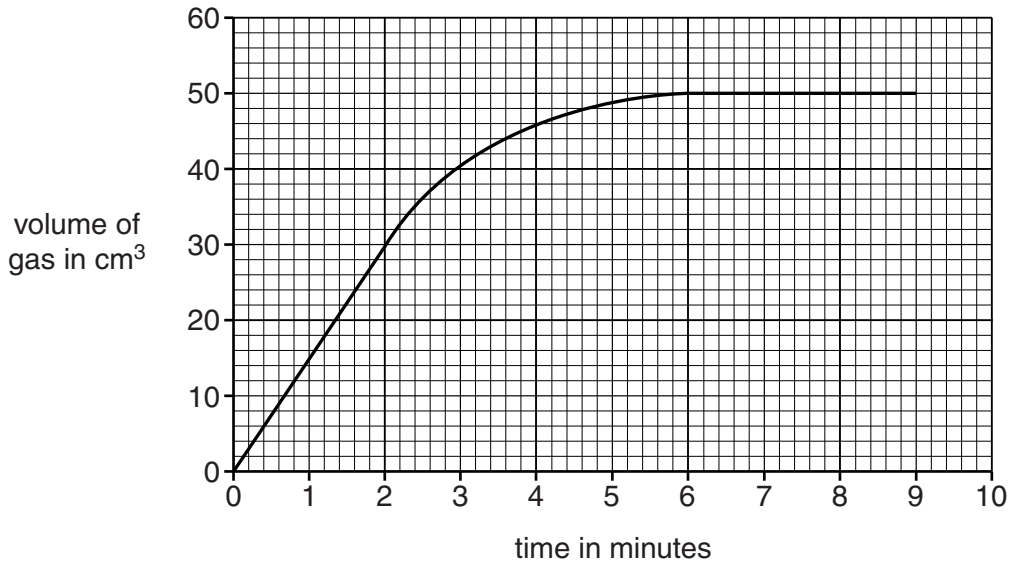
..... **[2]**

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



Jennie and Gary react an antacid tablet with 100 cm^3 of hydrochloric acid.

Look at the graph. It shows their results.



(i) How long does it take for the reaction to stop?

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

(ii) Calculate the average rate of this reaction during the first 2 minutes of the experiment.

.....

.....

answer ..... unit ..... **[2]**

(iii) The rate of reaction for the first 2 minutes is different to the rate of reaction between 2 and 4 minutes.

Describe how.

.....

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

(c) The rate of reaction between an antacid tablet and hydrochloric acid can be increased by

- increasing the concentration of the hydrochloric acid
- crushing the tablet.

Explain, using ideas about collisions between reacting particles, why these methods increase the rate of this reaction.

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

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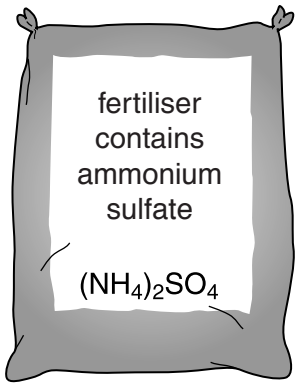
..... **[6]**

[Total: 12]

13 Fertilisers and medicines are useful chemicals.

Ammonium sulfate is used as a fertiliser.



Ammonium sulfate is made by reacting ammonia with dilute sulfuric acid.

The ammonia needed for this reaction is made in a **continuous** process.

This is different to the **batch** process used to make most medicines.

(a) (i) A continuous process is used to make ammonia but a batch process is used to make most medicines.

Explain why.

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

(ii) It is more expensive to make medicines than it is to make ammonium sulfate fertiliser.

Suggest why.

.....

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

(b) Alex makes some ammonium sulfate in a laboratory.

(i) Alex predicts he should make 8.0 g of ammonium sulfate.

He actually makes 6.0 g.

Show, by calculation, that his **percentage yield** of ammonium sulfate is 75%.

.....

.....

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

(ii) The companies who make ammonium sulfate fertiliser on an industrial scale want as high a percentage yield as possible.

Explain why.

.....

.....

.....

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

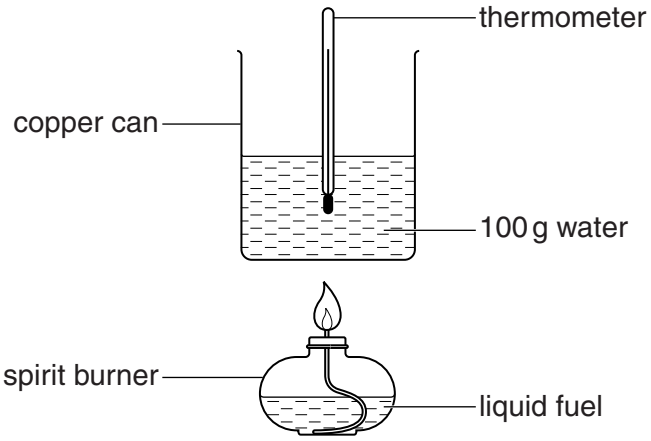
[Total: 7]

14 Stephanie is investigating some liquid fuels.

Stephanie investigates the energy given out by three different fuels.

Look at the diagram.

It shows the apparatus Stephanie uses.



Look at the table. It shows her results.

fuel	starting temperature of water in °C	final temperature of water in °C	temperature change in °C	mass of fuel burned in grams
paraffin	20	45	25	0.6
petrol	20	40	20	1.2
ethanol	18	48	30	1.8

(a) (i) Write down how Stephanie made her experiment a **fair test**.

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

(ii) Write down how Stephanie could **increase confidence** in her results.

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

(b) Look at the results for **paraffin**.

0.6 g of paraffin was used to heat 100 g of water.

Calculate the energy transferred **per gram** of paraffin.

Use the equation

energy = mass × specific heat capacity × temperature change

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

Give your answer to **three** significant figures.

.....

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.....

.....

answer ..... J/g **[2]**

(c) Stephanie decides to use paraffin in a camping stove, even though it is slightly more expensive per gram than ethanol or petrol.

Is this is a sensible choice? Use only the data in the table to explain your answer.

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.....

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

[Total: 6]

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.