

Candidate forename		Candidate surname	
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Centre number						Candidate number				
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**OXFORD CAMBRIDGE AND RSA EXAMINATIONS  
GENERAL CERTIFICATE OF SECONDARY EDUCATION**

**B641/02**

**GATEWAY SCIENCE**

**CHEMISTRY B**

**Unit 1 Modules C1 C2 C3 (Higher Tier)**

**MONDAY 17 JANUARY 2011: Morning**

**DURATION: 1 hour**

**SUITABLE FOR VISUALLY IMPAIRED CANDIDATES**

**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)**

**READ INSTRUCTIONS OVERLEAF**

## **INSTRUCTIONS TO CANDIDATES**

- **Write your name, centre number and candidate number in the boxes on the first page. Please write clearly and in capital letters.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **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).**
- **Answer ALL the questions.**

## **INFORMATION FOR CANDIDATES**

- **The number of marks is given in brackets [ ] at the end of each question or part question.**
- **The Periodic Table is provided.**
- **The total number of marks for this paper is 60.**

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**Answer ALL the questions.**

**SECTION A – MODULE C1**

**1 John is cooking a fish pie for Debbie.**

**Look at the food label for the fish pie he is cooking.**

**FISH PIE**

**FOOD LABEL**

**potato, salmon, prawn, water, milk, onion,  
double cream, skimmed milk powder,  
starch, cheddar cheese, lemon juice,  
parsley, E150, mustard powder, pepper**

**(a) E150 is a food additive.**

**Suggest why there are food additives in the fish pie.**

\_\_\_\_\_ [1]

**(b) John serves the fish pie with tomatoes.**

**The tomatoes are sold in a special kind of bag.**

**This is an example of ACTIVE PACKAGING because the bag absorbs gases that speed up the ripening of the fruit.**

**(i) Put a tick (✓) in the box next to ONE OTHER example of how active packaging can work.**

**jar of mayonnaise containing an emulsifier**

**packet with a sensor to tell when fruit is ripe**

**self-cooling drinks can**

**tinned fruit containing an antioxidant**

**[1]**

**(ii) Packing which removes water from inside the pack is another example of active packaging.**

**This helps to extend the shelf life of the food.**

**Explain how.**

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**[2]**

**[Total: 4]**

## 2 This question is about fuels.

(a) The table shows some information about four fuels.

fuel	state at room temperature	relative cost	energy value	method of delivery	how easy is it to light?
propane	gas	expensive	high	in small cylinders	easy
coal	solid	cheap	medium	in bags	difficult
natural gas	gas	moderate	high	supplied by underground pipes	easy
oil	liquid	expensive	high	in a metal tank	easy

Look at the picture of a camping stove.



**Which fuel is most suitable for a camping stove?**

**answer** \_\_\_\_\_

**Give reasons for your answer. Use information from the table.**

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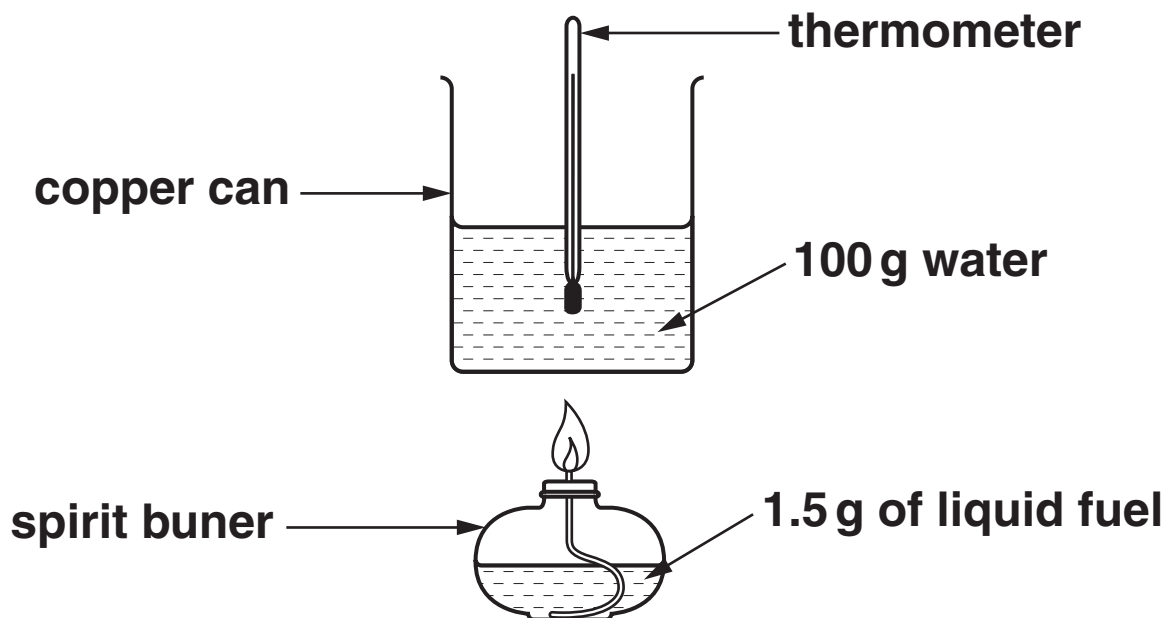
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\_\_\_\_\_ [2]

**(b) Karen and Phil investigate four different liquid fuels.**

**They want to find out which fuel releases most energy.**

**The diagram shows the apparatus they use.**



Look at Karen and Phil's results.

<b>fuel</b>	<b>temperature of water at start in °C</b>	<b>temperature of water at end in °C</b>	<b>temperature change in °C</b>
<b>A</b>	<b>18</b>	<b>29</b>	<b>11</b>
<b>B</b>	<b>15</b>	<b>34</b>	<b>19</b>
<b>C</b>	<b>15</b>	<b>25</b>	<b>10</b>
<b>D</b>	<b>19</b>	<b>35</b>	<b>16</b>

(i) Calculate the amount of energy transferred when fuel B burns.

**ENERGY TRANSFERRED = MASS × SPECIFIC HEAT CAPACITY × TEMPERATURE CHANGE**

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

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answer \_\_\_\_\_ J [2]



(ii) Karen and Phil burn 1.5 g of fuel C.

4200 J of energy is transferred.

Calculate the amount of energy transferred when 1.0 g of fuel C burns.

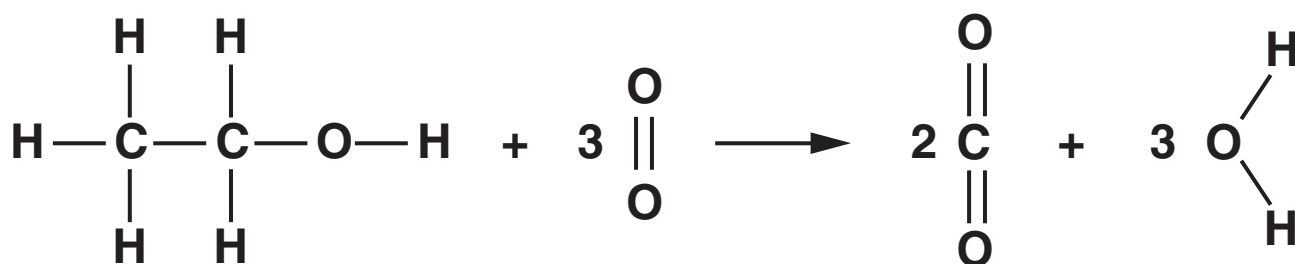
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answer \_\_\_\_\_ J [1]

(c) Fuel B is ethanol.

Look at this equation. It shows the complete combustion of ethanol.



The reaction is **EXOTHERMIC**.

**Look at the list of sentences.**

**One sentence is a correct explanation of an exothermic reaction.**

**Which one?**

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

**More energy is given out during bond breaking than is taken in during bond making.**

**More energy is given out during bond making than is taken in during bond breaking.**

**More bonds are broken than are made.**

**More energy is taken in during bond breaking than is given out during bond making.**

**[1]**

**[Total: 6]**

**3 Colette uses nail varnish remover to remove her nail varnish.**

**The nail varnish remover dissolves the nail varnish.**

**(a) The nail varnish remover contains a type of chemical called an ESTER.**

**Complete the following sentence.**

**Choose the best answer from the list.**

**SOLUTE**

**SOLUTION**

**SOLVENT**

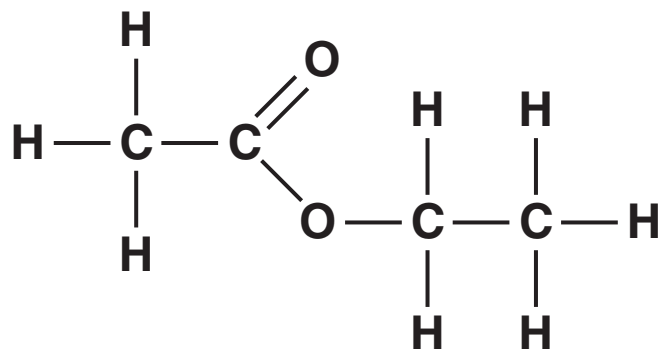
**SYNTHETIC MATERIAL**

**The ester in nail varnish remover is used because**

**it is a \_\_\_\_\_ [1]**

**(b) Ethyl ethanoate is an ester.**

**Look at the displayed formula of ethyl ethanoate.**



**(i) Write down the MOLECULAR FORMULA for ethyl ethanoate.**

\_\_\_\_\_ [1]

**(ii) Ethyl ethanoate is NOT a hydrocarbon.**

**Explain how you can tell from the displayed formula.**

\_\_\_\_\_  
\_\_\_\_\_ [1]

**[Total: 3]**

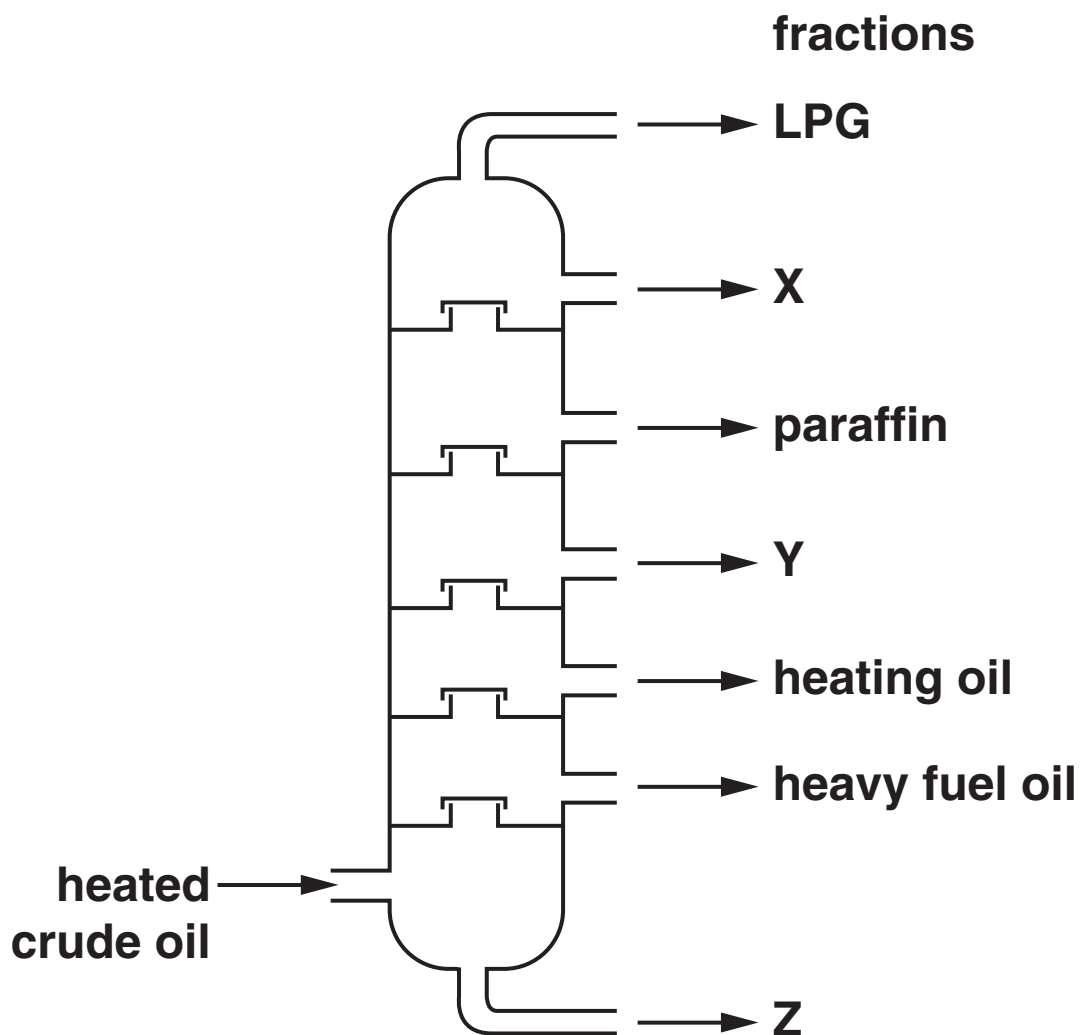
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**4 This question is about crude oil.**

**(a) Crude oil is separated into different parts by fractional distillation.**

**Look at the diagram.**

**It shows a fractionating column.**



**What are the names of the missing fractions X, Y and Z?**

**Choose your answers from the list.**

**BITUMEN**

**DIESEL**

**PETROL**

**Fraction X is \_\_\_\_\_**

**Fraction Y is \_\_\_\_\_**

**Fraction Z is \_\_\_\_\_ [2]**

**(b) (i) Which of the fractions has the LOWEST boiling temperature?**

\_\_\_\_\_ [1]

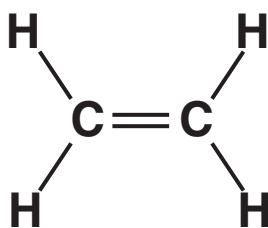
**(ii) Which of the fractions contains the LARGEST molecules?**

\_\_\_\_\_ [1]

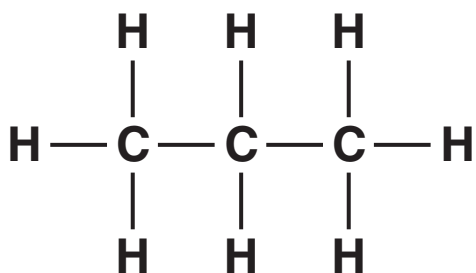
**[Total: 4]**

5 This question is about compounds that contain carbon.

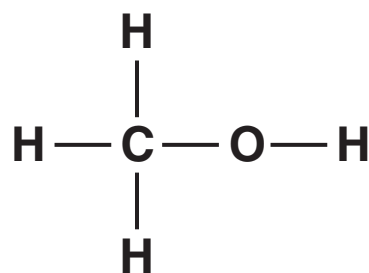
Look at the displayed formulas of some compounds.



**ETHENE**



**PROPANE**



**METHANOL**

(a) Propane is an ALKANE.

Write down how you can tell propane is an alkane.

\_\_\_\_\_ [1]



**(b) Methanol, CH<sub>3</sub>OH, burns in oxygen, O<sub>2</sub>.**

**Carbon dioxide and water are made.**

**Write a BALANCED SYMBOL equation for this reaction.**

\_\_\_\_\_ [2]

**[Total: 3]**

## SECTION B – MODULE C2

6 This question is about metals.

Look at the table. It shows the properties of some metals and an alloy.

metal	melting point in °C	density in g/cm <sup>3</sup>	relative electrical conductivity	cost per tonne in £
aluminium	660	2.7	40	1350
copper	1083	8.9	64	3800
iron	1535	7.9	11	400
lead	328	11.3	5	1500
silver	962	10.5	67	20 000
solder	188	8.2	7	6700
tin	232	5.7	9	10 000

(a) Solder is used for joining electrical wires.

Suggest why. Use information from the table.

\_\_\_\_\_ [1]

(b) Aluminium is used for making aeroplane bodies.

Apart from cost, suggest why. Use information from the table.

\_\_\_\_\_ [1]

**(c) Car bodies can be made from aluminium or from iron.**

**Explain one ADVANTAGE and one DISADVANTAGE of using aluminium to make car bodies.**

**Use the table to help you.**

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**[2]**

**[Total: 4]**

**7 This question is about paints.**

**Paints contain a SOLVENT, a BINDING MEDIUM and a PIGMENT.**

**(a) Pigments give the paint its colour.**

**Some pigments are THERMOCHROMIC.**

**Thermochromic pigments change colour when they are heated.**

**Write down ONE use of thermochromic pigments.**

\_\_\_\_\_ [1]

**(b) In oil paints the pigment is dispersed in an oil.**

**Oil paints dry slowly.**

**The first stage of the drying process is the evaporation of the solvent.**

**What happens to the oil in the next stage of the drying process?**

\_\_\_\_\_  
\_\_\_\_\_ [1]

**(c) Paints are COLLOIDS.**

**Look at the sentences about colloids.**

**Which sentences about colloids are correct?**

**Put ticks (✓) in the boxes next to the TWO correct sentences.**

**Particles are mixed and dispersed through a liquid.**

**Solid particles are dissolved in a liquid.**

**A colloid is a single compound.**

**Solid particles are suspended in a liquid.**

**A colloid is two separated liquids.**

**[2]**

**[Total: 4]**

## 8 Emily investigates antacid tablets.

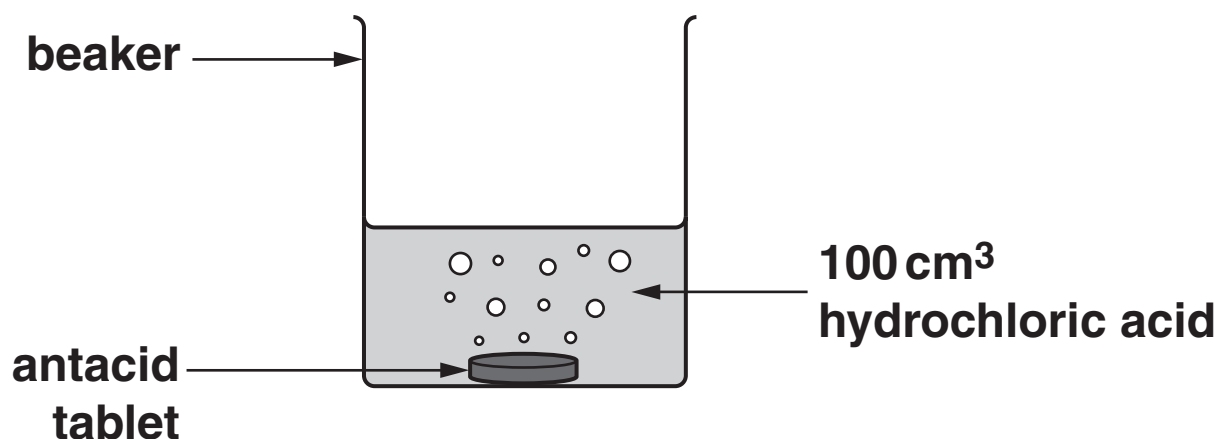
Antacids neutralise excess acid in your stomach.

Emily uses one tablet in each experiment.

She adds the tablet to 100 cm<sup>3</sup> of hydrochloric acid.

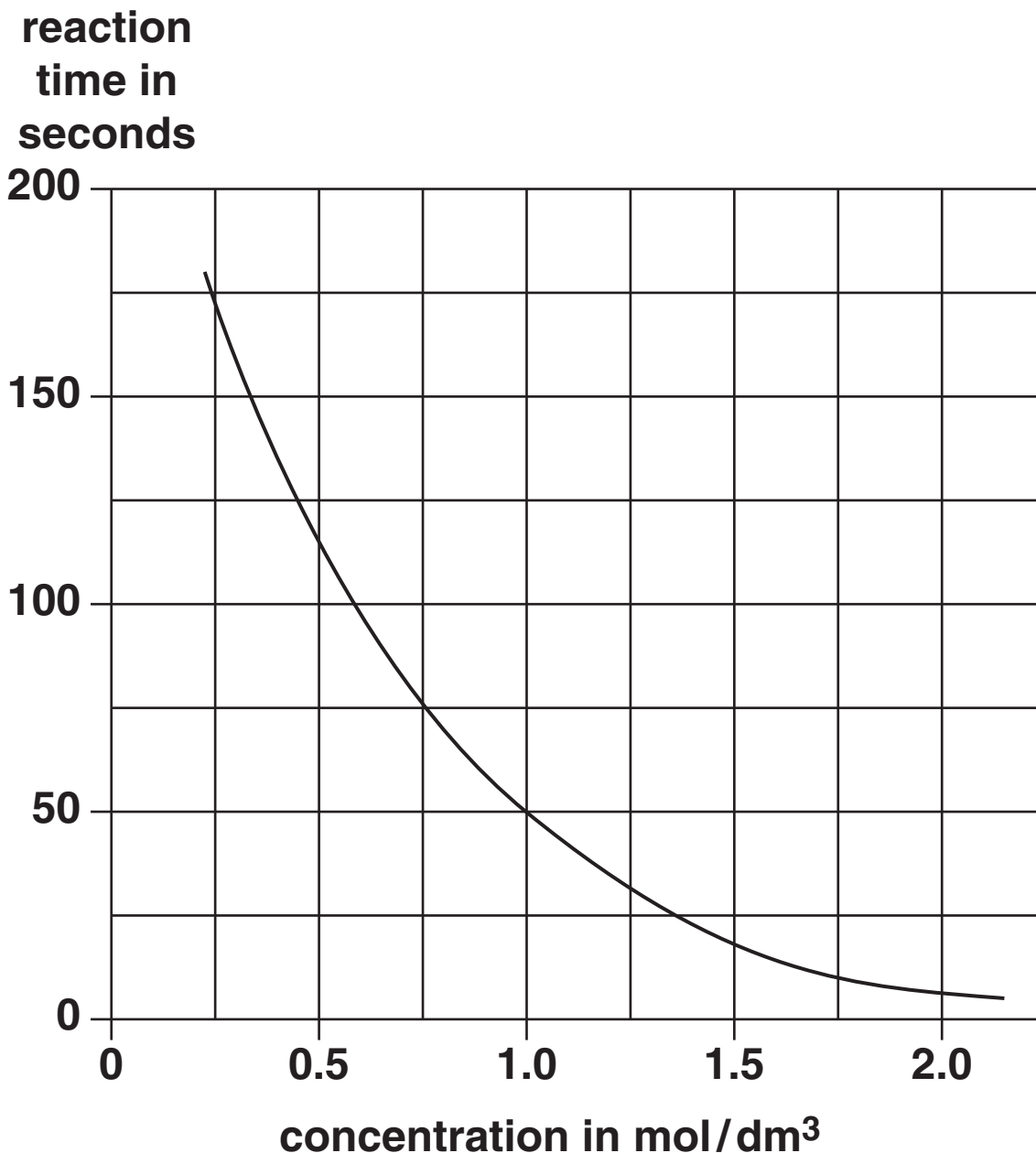
She measures the time it takes to fully react. This is the **REACTION TIME**.

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



Emily does the experiment several times. Each time she uses a different concentration of acid.

Look at the graph of Emily's results.



(a) Emily uses hydrochloric acid with a concentration of 1.5 mol/dm<sup>3</sup>.

Look at the graph.

What is the reaction time?

\_\_\_\_\_ seconds

[1]

- (b) Emily finds that the reaction time is shorter with CONCENTRATED acid than with DILUTE acid.**

**Explain why. Use ideas about particles.**

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**[2]**

- (c) Emily repeats the experiment using a CRUSHED tablet.**

**She finds that the reaction is faster.**

**Explain why. Use ideas about collisions between particles.**

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**[2]**



**(d) These antacid tablets contain calcium carbonate.**

**In this reaction, calcium carbonate,  $\text{CaCO}_3$ , reacts with hydrochloric acid,  $\text{HCl}$ .**

**Calcium chloride,  $\text{CaCl}_2$ , carbon dioxide and water are made.**

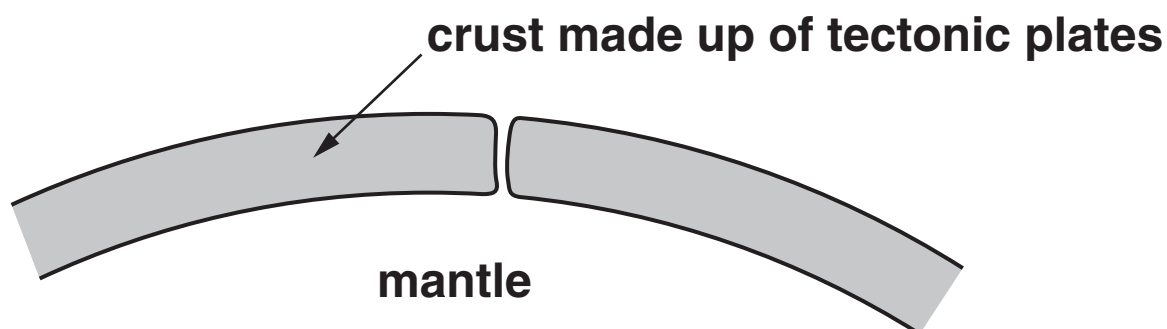
**Write a BALANCED SYMBOL equation for this reaction.**

\_\_\_\_\_ [2]

**[Total: 7]**

**9 This question is about tectonic plates.**

**Look at the diagram. It shows the outer layers of the Earth.**



**(a) One type of tectonic plate is an OCEANIC plate.**

**Write down the name of the other TYPE of tectonic plate.**

\_\_\_\_\_ [1]

**(b) Tectonic plates float ON TOP OF the mantle.**

**Explain why.**

\_\_\_\_\_ [1]

**(c) Tectonic plates move slowly.**

**What causes tectonic plates to move?**

\_\_\_\_\_  
\_\_\_\_\_ [1]

**(d) The two types of plate collide.**

**The oceanic plate goes underneath the other plate.**

**The oceanic plate then remelts.**

**What is the name of this process?**

\_\_\_\_\_ [1]

**(e) What is meant by the word LITHOSPHERE?**

\_\_\_\_\_ [1]

**[Total: 5]**

## SECTION C – MODULE C3

10 This question is about atomic structure.

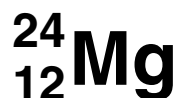
Look at the table. It shows some information about the particles which make up atoms.

particle	charge	relative mass
proton	_____	1
electron	negative	0.0005
neutron	neutral	_____

(a) Complete the table.

[2]

(b) Look at the symbol for magnesium.



The MASS NUMBER of magnesium is 24.

(i) What is meant by mass number?

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[1]

**(ii) Write down the ELECTRONIC STRUCTURE of magnesium.**

\_\_\_\_\_ [1]

**(iii) A magnesium atom is electrically NEUTRAL.**

**Explain why.**

\_\_\_\_\_  
\_\_\_\_\_ [1]

**[Total: 5]**

**11 Sodium, potassium and lithium are Group 1 metals.**

**The Group 1 metals react when put into water.**

**Look at the table.**

<b>metal</b>	<b>time for 0.5 g of metal to react in seconds</b>	<b>observations</b>
<b>sodium</b>	<b>12</b>	<b>melts skates across surface of water gas given off alkaline solution made</b>
<b>potassium</b>	<b>6</b>	<b>melts and catches fire skates across surface of water gas given off alkaline solution made</b>
<b>lithium</b>	<b>20</b>	<b>skates across surface of water gas given off alkaline solution made</b>

**(a) All three reactions give off the same gas.**

**Write down the name of this gas.**

\_\_\_\_\_ [1]

**(b) Look at the observations for sodium.**

**Write down the name of the substance that makes the solution alkaline.**

\_\_\_\_\_ [1]

**(c) What is the flame colour when potassium burns?**

\_\_\_\_\_ [1]

**(d) Rubidium is another element in Group 1.**

**It is BELOW lithium, sodium and potassium.**

**Predict the observations you should get when 0.5g of rubidium reacts with water.**

**Your answer should include**

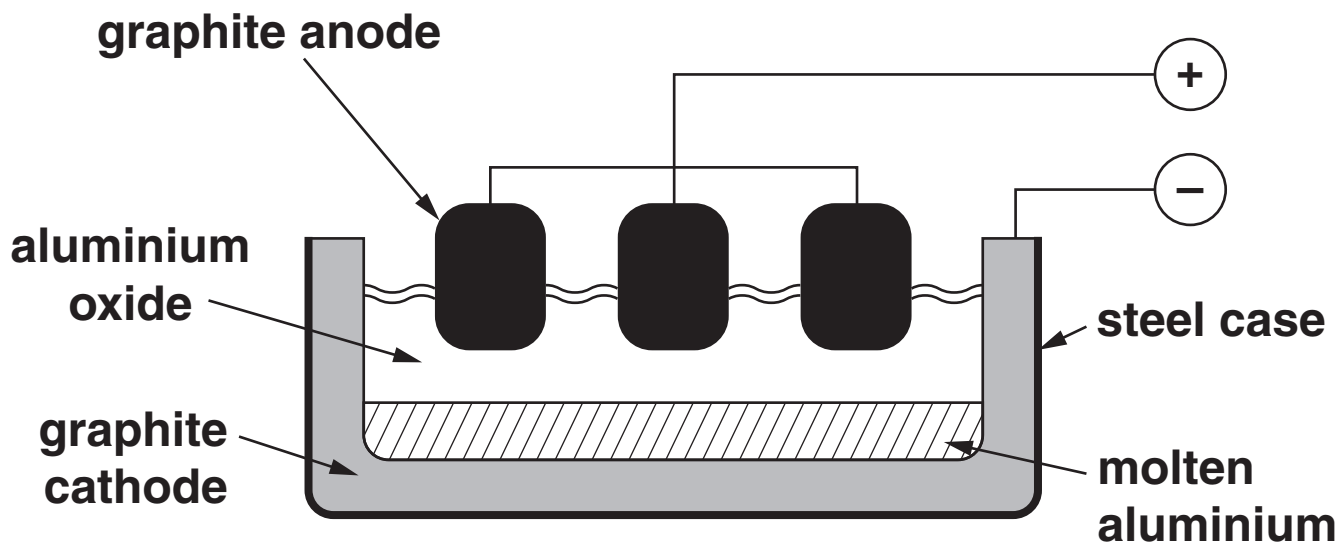
- an estimate of the time it takes to react**
- what you would see.**

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ [2]

**[Total: 5]**

**12 This question is about the extraction of aluminium.**

**Look at the diagram. It shows the equipment used.**



**(a) Aluminium oxide is broken down into aluminium and oxygen.**

**Write a WORD equation for this reaction.**

\_\_\_\_\_ [1]

**(b) Oxygen is made at one of the electrodes.**

**Which one?**

\_\_\_\_\_ [1]



**(c) Aluminium ions,  $Al^{3+}$ , gain electrons to make aluminium atoms,  $Al$ .**

**Write a BALANCED SYMBOL equation for this reaction. Use  $e^-$  to represent an electron.**

\_\_\_\_\_ [2]

**[Total: 4]**

**13 There are three types of bonding.**

**They are**

- **ionic bonding**
- **covalent bonding**
- **metallic bonding.**

**(a) Sodium chloride is an ionic compound.**

**Write down ONE property of sodium chloride.**

**Choose from**

**CONDUCTS ELECTRICITY WHEN MOLTEN**

**CONDUCTS ELECTRICITY WHEN SOLID**

**INSOLUBLE IN WATER**

**LOW MELTING POINT**

**answer \_\_\_\_\_ [1]**

**(b) Metals conduct electricity.**

**Explain how. Use ideas about metallic bonding.**

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\_\_\_\_\_ [2]

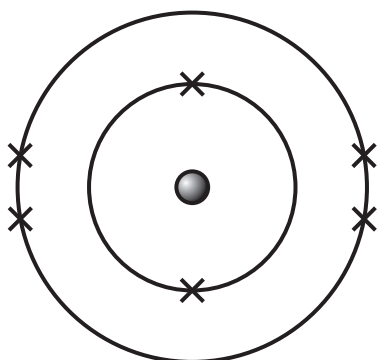
**(c) Electrons are shared between atoms in covalent bonding.**

**What happens to the electrons in IONIC bonding?**

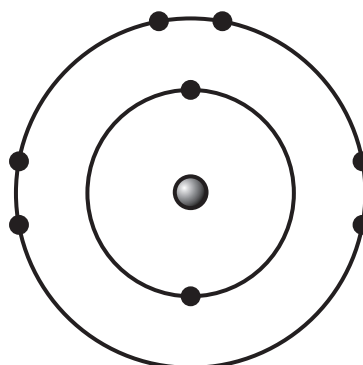
\_\_\_\_\_ [1]

**(d) Carbon dioxide is a covalent compound.**

**Look at the electronic structures of carbon and oxygen.**



**carbon 2.4.**



**oxygen 2.6.**

**Electrons are shared when covalent bonds are made.**

**Draw a 'dot and cross' diagram to show a molecule of carbon dioxide, CO<sub>2</sub>.**

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

1 <b>H</b> hydrogen 1
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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.