

**OXFORD CAMBRIDGE AND RSA EXAMINATIONS**  
**GCSE**

**B711/02**

**GATEWAY SCIENCE**  
**SCIENCE B**

**Science modules B1, C1, P1**  
**(Higher Tier)**

**WEDNESDAY 20 MAY 2015: Afternoon**

**DURATION: 1 hour 15 minutes**  
**plus your additional time allowance**

**MODIFIED ENLARGED**

<b>Candidate forename</b>		<b>Candidate surname</b>	
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<b>Centre number</b>						<b>Candidate number</b>				
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**Candidates answer on the Question Paper.**  
**A calculator may be used for this paper.**

**OCR SUPPLIED MATERIALS:**  
**A copy of the Periodic Table**

**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. 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).**

## **INFORMATION FOR CANDIDATES**

**The quality of written communication is assessed in questions marked with a pencil ().**

**A list of equations can be found on pages 4–5.**

**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.**

**Any blank pages are indicated.**

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## **EQUATIONS**

$$\text{energy} = \text{mass} \times \frac{\text{specific heat}}{\text{capacity}} \times \text{temperature change}$$

$$\text{energy} = \text{mass} \times \text{specific latent heat}$$

$$\text{efficiency} = \frac{\text{useful energy output} (\times 100\%)}{\text{total energy input}}$$

$$\text{wave speed} = \text{frequency} \times \text{wavelength}$$

$$\text{power} = \text{voltage} \times \text{current}$$

$$\text{energy supplied} = \text{power} \times \text{time}$$

$$\text{average speed} = \frac{\text{distance}}{\text{time}}$$

$$\text{distance} = \text{average speed} \times \text{time}$$

$$s = \frac{(u + v)}{2} \times t$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

**force = mass × acceleration**

**weight = mass × gravitational field strength**

**work done = force × distance**

**power =  $\frac{\text{work done}}{\text{time}}$**

**power = force × speed**

**KE =  $\frac{1}{2}mv^2$**

**momentum = mass × velocity**

**force =  $\frac{\text{change in momentum}}{\text{time}}$**

**GPE = mgh**

**mgh =  $\frac{1}{2}mv^2$**

**resistance =  $\frac{\text{voltage}}{\text{current}}$**

**Answer ALL the questions.**

## **SECTION A – Module B1**

- 1 Jake wants to find out how much protein he should eat each day.**

**He finds information from two different sources.**

### **SOURCE 1**

**The table shows the amount of protein people of different ages should eat each day.**

<b>AGE GROUP</b>	<b>AMOUNT OF PROTEIN IN g</b>
<b>Infants</b>	<b>10</b>
<b>Teenage males</b>	<b>52</b>
<b>Teenage females</b>	<b>46</b>
<b>Adult males</b>	<b>56</b>
<b>Adult females</b>	<b>46</b>

### **SOURCE 2**

**Your estimated average daily intake of protein can be calculated using the formula.**

$$\text{EAR in g} = 0.6 \times \text{body mass in kg}$$

**(EAR) Estimated Average Requirement**

**(a) Jake is a teenage male. He has a mass of 70 kg.**

**The amounts of protein recommended by Source 1 and Source 2 are different.**

**(i) Calculate Jake's EAR.**

**Use your calculation to decide which source recommends that Jake eats the MOST protein.**

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

**(ii) Suggest TWO reasons why the recommended amounts of protein are different.**

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

**(b) Jake's mum has the same mass as Jake.**

**This means they have the same EAR.**

**Jake needs to eat more protein each day than his mum to stay healthy.**

**Explain why their daily intake of protein should be different even though the EAR is the same.**

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**[2]**



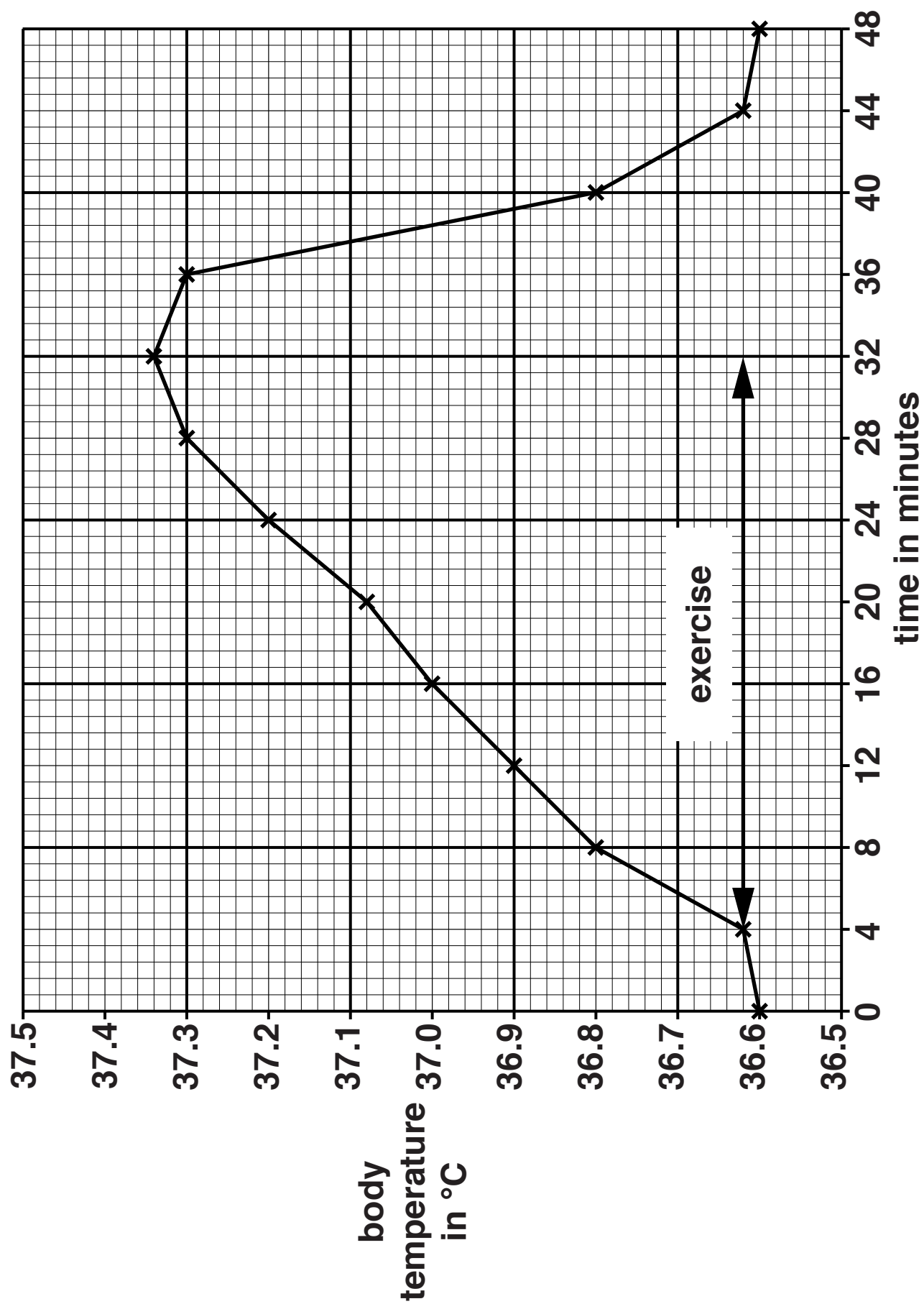
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**2 Jess and Neil investigate the effect of exercise on body temperature.**

**Jess measures Neil's body temperature every four minutes for 48 minutes.**

**Neil exercises for 28 minutes of this time.**

**The graph opposite shows the change in Neil's body temperature.**



- (a) Explain how SWEATING and NEGATIVE FEEDBACK mechanisms cause the changes shown in the graph.**

**Use data from the graph in your answer.**



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

[illegible]

- (b) People who don't exercise enough sometimes develop high blood pressure.**

**Write down ONE OTHER factor that could INCREASE blood pressure.**

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

- (c) Energy is needed for exercise.**

**Fats are one type of food that can provide energy for the body.**

- (i) Which TWO molecules are fats made up of?**

**Put a ring around each correct answer.**

**AMINO ACID**

**FATTY ACIDS**

**GLUCOSE**

**GLYCEROL**

**STARCH**

**[1]**

- (ii) Where and how are fats stored in the body?**

\_\_\_\_\_

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

### **3 Read this information about multiple sclerosis and cannabis.**

**People with a medical condition called multiple sclerosis (MS) often have very painful symptoms.**

**A study of more than 600 MS patients has shown that taking cannabis can relieve some of the symptoms.**

**A scientist working on the trial says that the study has made NHS prescribing of cannabis-based drugs more likely.**

**In some countries, MS patients smoke cannabis mixed with tobacco. It is also possible to take cannabis without mixing it with tobacco. In other countries the possession of cannabis is illegal.**

**(a) Smoking cannabis mixed with tobacco has many risks.**

**The risks to MS patients smoking cannabis can be reduced by making cannabis a prescription drug.**

**Use the information to help you describe and explain one OTHER way the risks can be reduced.**

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**[2]**

**(b) To make the study more reliable a BLIND TRIAL was used.**

**Describe how a blind trial would be done for this study.**

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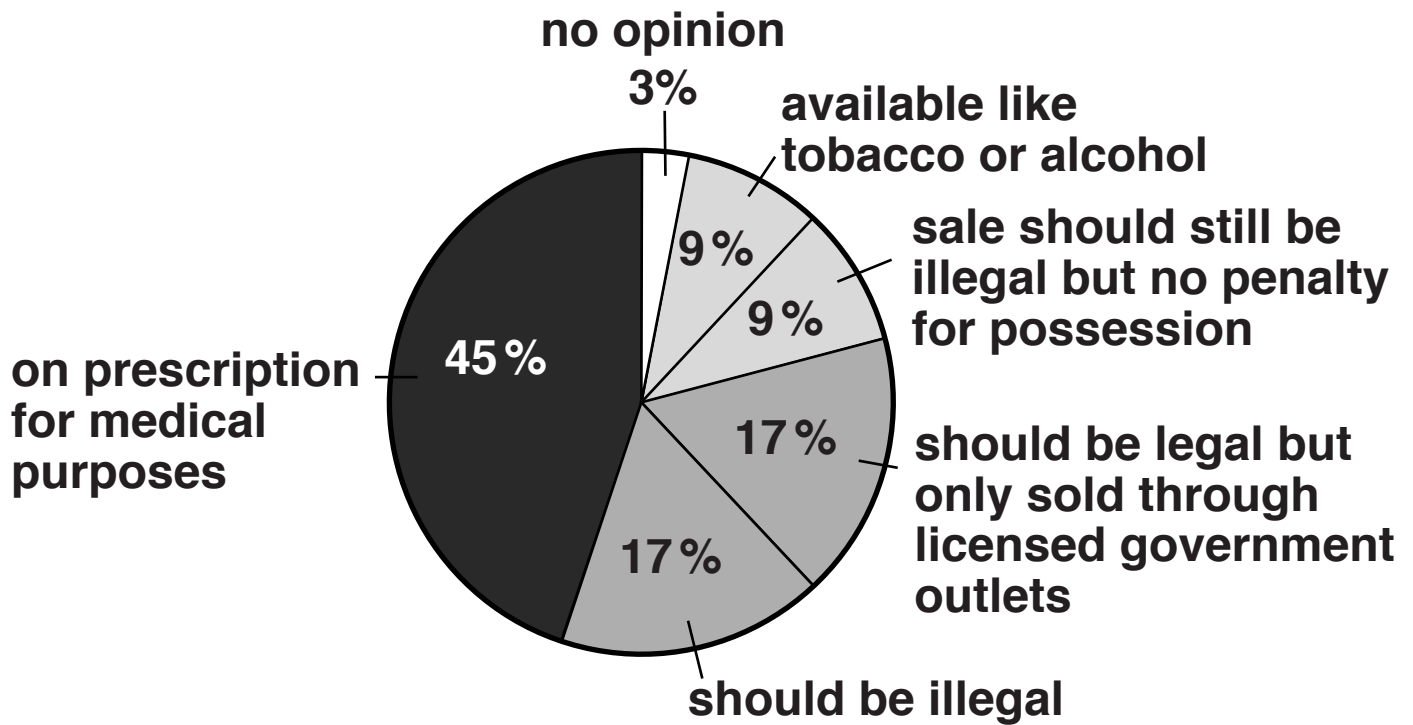
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**[2]**

**(c) Some people think cannabis should be made legal in the United Kingdom.**

**Look at the chart. It shows the results of an opinion poll about making cannabis legal.**





**Read these conclusions about the data.**

**Put a tick (✓) next to the TWO conclusions that match the data.**

**35% think you should be able to get cannabis on prescription.**

☐

**26% think you should be able to buy cannabis without a prescription.**

☐

**9% think you should be able to buy cannabis without a prescription from a licensed outlet.**

☐

**26% think that the sale of cannabis should be illegal.**

☐

**Less than 50% think cannabis should be made legal either with or without a prescription.**

☐

**[2]**

#### **4 This question is about genetics.**

**A scientist called Mendel studied the inheritance of characteristics in peas.**

**(a) Nalshed and Jill copy some of Mendel's experiments.**

**The table shows their experiments and some of their results.**

<b>Experiment</b>	<b>Description of experiment</b>	<b>Number of offspring</b>	<b>Offspring type</b>
<b>1</b>	<b>crossed tall plants with short plants</b>	<b>282</b>	<b>all tall</b>
<b>2</b>	<b>crossed the offspring from experiment 1 with each other</b>	<b>280</b>	<b>210 tall 70 short</b>
<b>3</b>	<b>crossed offspring from experiment 1 with short plants</b>	<b>260</b>	

**There were 260 offspring from EXPERIMENT 3.**

**Predict how many of these offspring from experiment 3 will be tall and how many will be short.**

**Use the letters T and t and a diagram to help you.**

**Number of tall offspring \_\_\_\_\_**

**Number of short offspring \_\_\_\_\_ [2]**

- (b) Mendel's work on inheritance was not recognised until after his death.**

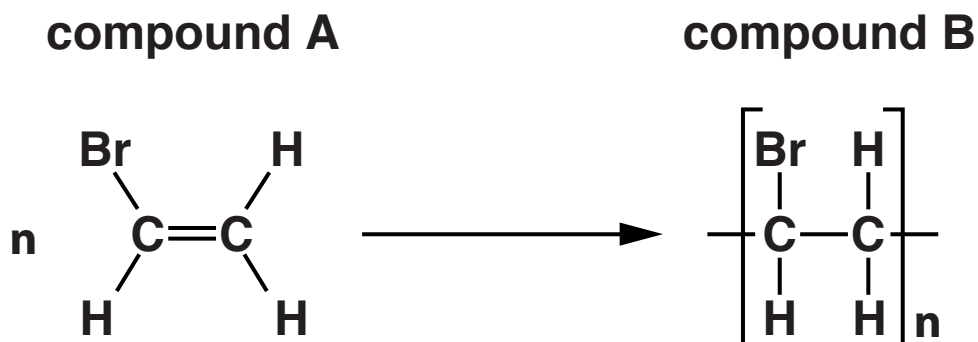
**Scientists used papers Mendel had written to help them explain their own investigations.**

**Use these ideas to explain why it is important that Mendel published his work.**

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

## SECTION B – Module C1

**5 This question is about carbon compounds.**



**(a) Look at the displayed formula of compound A.**

**(i) Compound A is NOT a hydrocarbon.**

## Explain why.

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[1]

**(ii) Write down the MOLECULAR FORMULA for compound A.**

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[1]

**(b) Compound A is changed into compound B in a process called polymerisation.**

**Describe, including the conditions needed, the process of polymerisation.**

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**[3]**

**(c) What type of compound is compound B?**

**Choose from the list.**

**ALKANE**

**ALKENE**

**DIBROMO**

**SATURATED**

**UNSATURATED**

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**[1]**

**6 Louise buys a new bottle of perfume.**

**(a) The perfume contains a chemical called an ESTER.**

**Complete the WORD EQUATION for the reaction used to make an ester.**

\_\_\_\_\_ + alcohol → ester + water  
[1]

**(b) Louise buys some nail varnish remover.**

**Her nail varnish remover contains an ester.**

**The ester is a solvent.**

**Louise's nail varnish remover dissolves nail varnish.**

**Water does not dissolve nail varnish.**

**Explain, using ideas about particles, why water will not dissolve nail varnish.**

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

**7 Duncan investigates the combustion of four different fuels.**

**He burns the same volume of fuel in each experiment.**

**Look at his results.**

<b>Fuel</b>	<b>Is carbon dioxide made?</b>	<b>Is carbon monoxide made?</b>	<b>Is soot made?</b>	<b>Energy given out in J</b>	<b>Cost per litre in £</b>
<b>A</b>	✓	✗	✗	<b>4200</b>	<b>6.00</b>
<b>B</b>	✓	✓	✗	<b>2900</b>	<b>4.00</b>
<b>C</b>	✗	✓	✓	<b>1100</b>	<b>1.30</b>
<b>D</b>	✓	✗	✗	<b>3800</b>	<b>3.00</b>

**(a) Which fuel would be best for Duncan to use to heat his house?**

**Use information from the table to explain your answer.**

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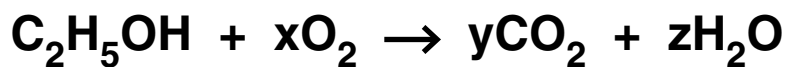
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**[3]**

**(b) Fuel A is ethanol.**

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



**What are the numbers x, y and z that balance this equation?**

**x = \_\_\_\_\_**

**y = \_\_\_\_\_**

**z = \_\_\_\_\_**

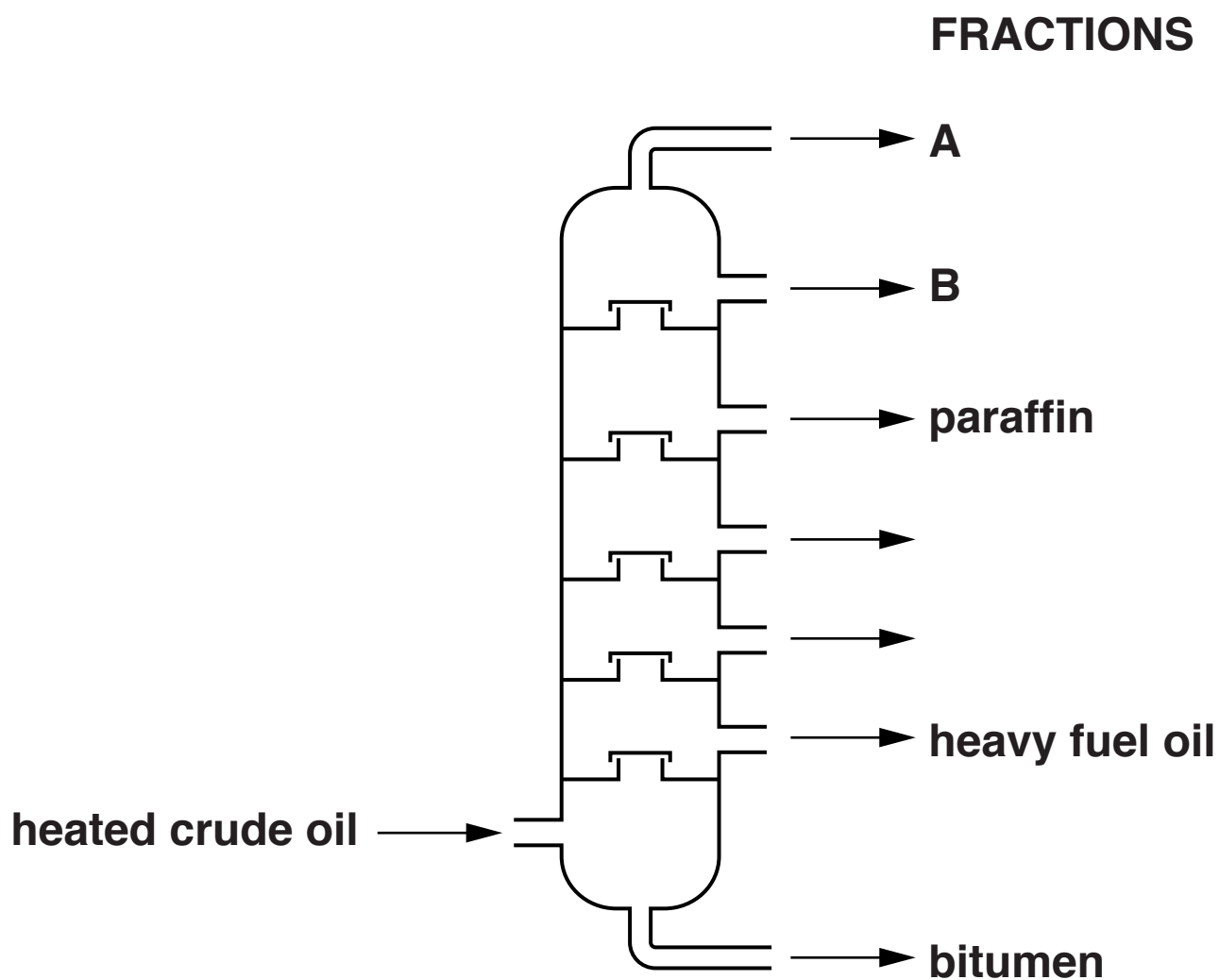
**[1]**



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

**Crude oil can be separated into useful substances called fractions.**



**(a) What are the names of the missing fractions A and B?**

**Choose your answers from the list.**

**DIESEL**

**HEATING OIL**

**LPG**

**METHANE**

**PETROL**

**Fraction A is \_\_\_\_\_**

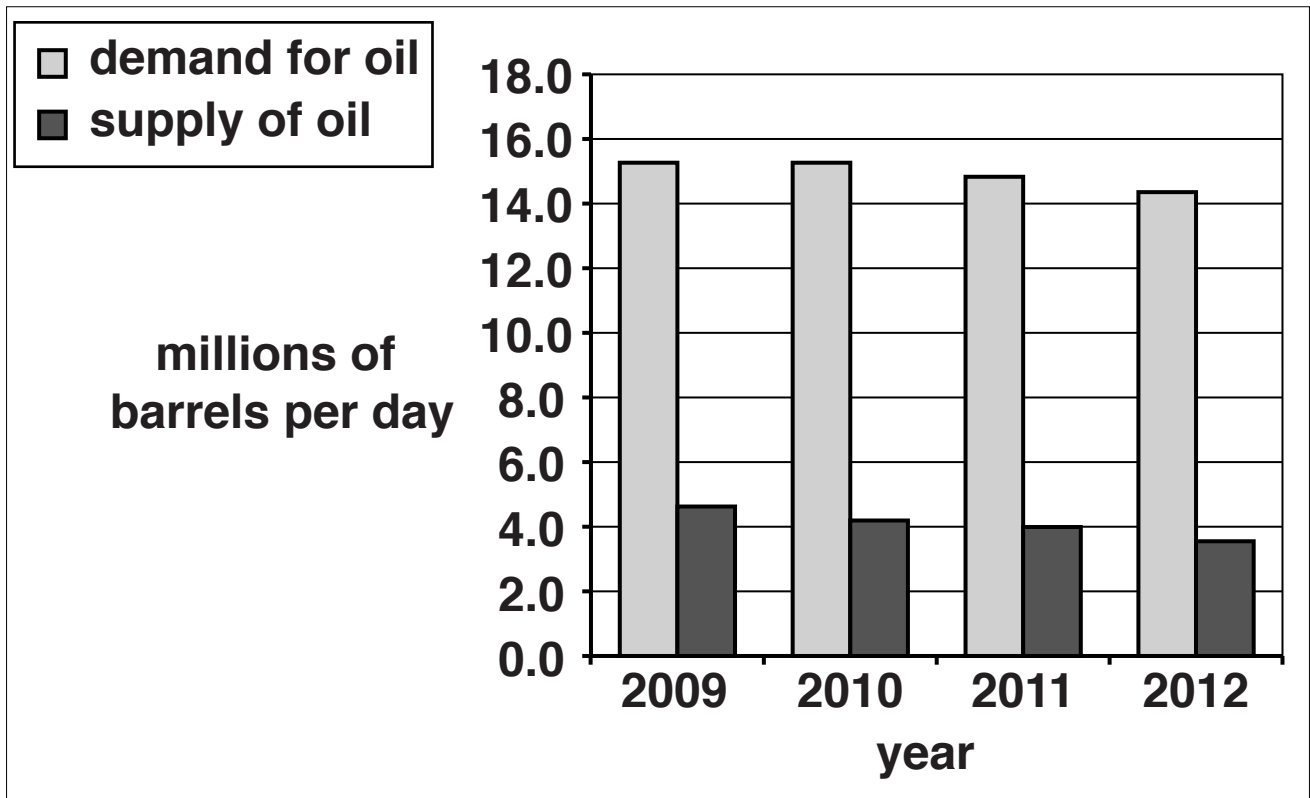
**Fraction B is \_\_\_\_\_**

**[1]**

(b) Look at the graph.

The graph shows the **PRODUCTION** of oil in Europe from 2009 to 2012.

It also shows the **DEMAND** for oil in Europe in the same period.



What trends can you deduce about the supply and demand of crude oil from 2009 to 2012?

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[2]

(c) Look at the information about two substances found in crude oil.

Molecular formula	<div>C<sub>2</sub>H<sub>6</sub></div>	→	<div>C<sub>8</sub>H<sub>18</sub></div>
Boiling point	<div></div>	→	<div></div>
Intermolecular forces	<div></div>	→	<div></div>

Complete the boxes to show how the **BOILING POINTS** and **INTERMOLECULAR FORCES** compare for these two substances.

Choose words from the list.

COVALENT

HIGH

IONIC

LOW

STRONG

WEAK

[2]

(d) Distillation of C<sub>8</sub>H<sub>18</sub> does not make individual carbon and hydrogen atoms.

Explain why.

\_\_\_\_\_

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

**9 This question is about polymers A and B.**

**Look at the table.**

**It gives some information about polymers A and B.**

	<b>A</b>	<b>B</b>
<b>Density in g/cm<sup>3</sup></b>	<b>0.91</b>	<b>0.97</b>
<b>Melting point in °C</b>	<b>80</b>	<b>270</b>
<b>Relative strength</b>	<b>11.8</b>	<b>31.4</b>
<b>Relative flexibility</b>	<b>flexible</b>	<b>rigid</b>



**Explain, using information from the table, which polymer would be best for making water pipes. Relate the melting points of the two polymers A and B to a simple model of their structures.**



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

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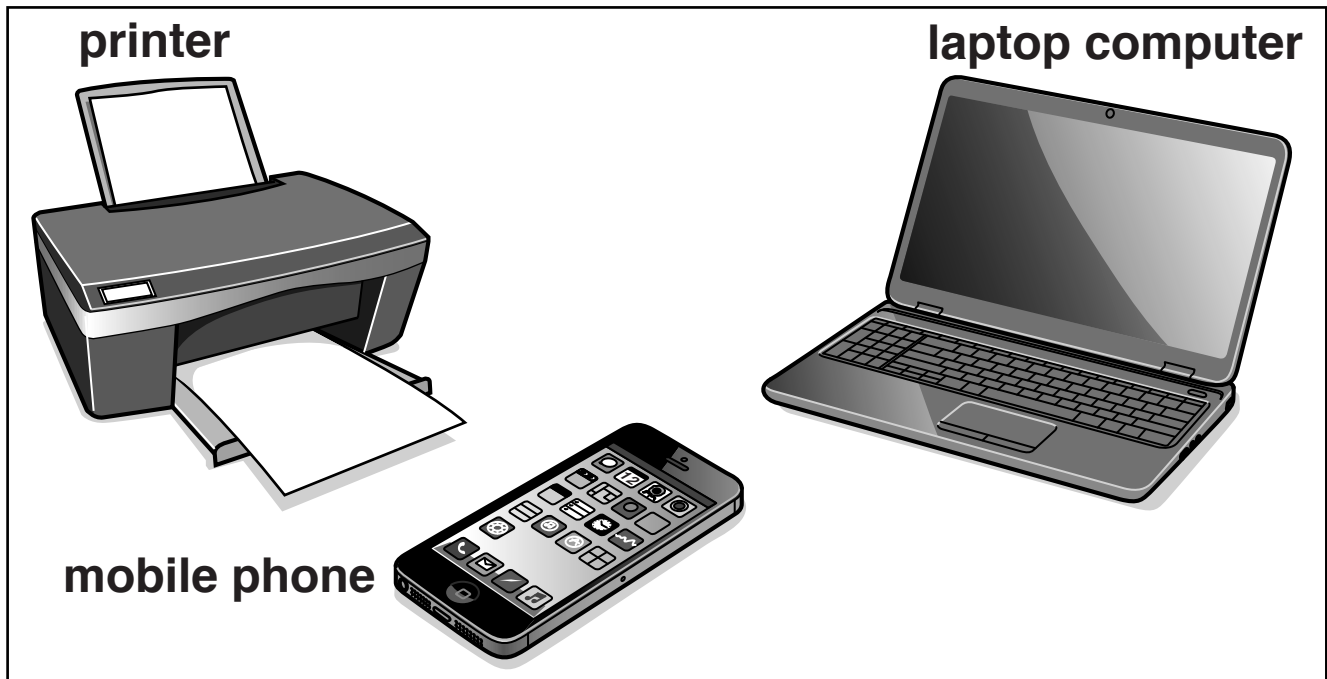
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**[6]**

## SECTION C – Module P1

10 OCRA is an advertising company.

Here is a picture from one of their adverts.



The advert is about using wireless technology.

- (a) Wireless technology allows these three devices to communicate with each other.

Describe why wireless communication does NOT always work for these devices.

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[2]



**(b) The laptop computer has an INFRARED mouse.**



**Describe the TYPE of signals the infrared mouse uses and explain how the signals can be used to control different functions on the laptop computer.**

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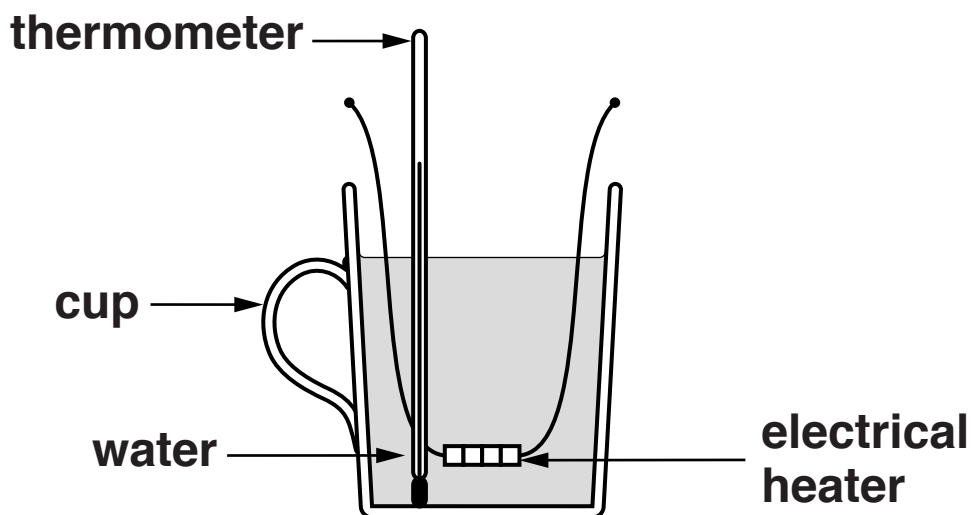
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**[2]**

**11 Emily does an experiment to calculate the energy needed to change the temperature of water.**

**(a) Here is the apparatus she uses.**



**Emily does the experiment three times.**

**Each time she changes the temperature of the water by different amounts.**

**Look at her results.**

<b>Mass of water in kg</b>	<b>Initial temperature in °C</b>	<b>Final temperature in °C</b>	<b>Energy absorbed by water in J</b>	<b>Energy supplied by heater in J</b>
<b>0.2</b>	<b>20</b>	<b>55</b>	<b>29400</b>	<b>49000</b>
<b>0.2</b>	<b>20</b>	<b>35</b>	<b>12600</b>	<b>18000</b>
<b>0.2</b>	<b>20</b>		<b>8400</b>	<b>10000</b>

**The specific heat capacity of water is  $4200 \text{ J/kg}^\circ\text{C}$ .**

**Calculate the missing final temperature in the table using the energy absorbed by the water.**

**Explain what Emily's results show using ALL the data from the table.**

[illegible]

**(b) Emily thinks that her results will change if she insulates the cup.**

**(i) What things can Emily do to the cup to reduce heat loss by CONDUCTION and CONVECTION?**

**conduction can be reduced by: \_\_\_\_\_**

\_\_\_\_\_

**convection can be reduced by: \_\_\_\_\_**

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

**(ii) Emily measures how long it takes to increase the temperature of this water by  $60^{\circ}\text{C}$ . This takes 5 minutes.**

**She repeats this experiment with the same mass of water in an insulated cup.**

**Suggest what effect this has on the time taken to heat the water by  $60^{\circ}\text{C}$ .**

**Explain your answer.**

\_\_\_\_\_

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

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**12 Scientists have measured the amount of ozone in the upper atmosphere.**

**They have also measured the strength of ‘long waves’.**

**‘Long waves’ are bands of energy found in the upper atmosphere.**

**They help to keep the temperature of the upper atmosphere constant.**

**Opposite are the ozone and long wave measurements for the years 1984 and 1997.**

**(a) Scientists believe that the strength of the ‘long waves’ and the amount of ozone in the upper atmosphere are linked.**

**Use the information to explain why scientists think there is a link.**

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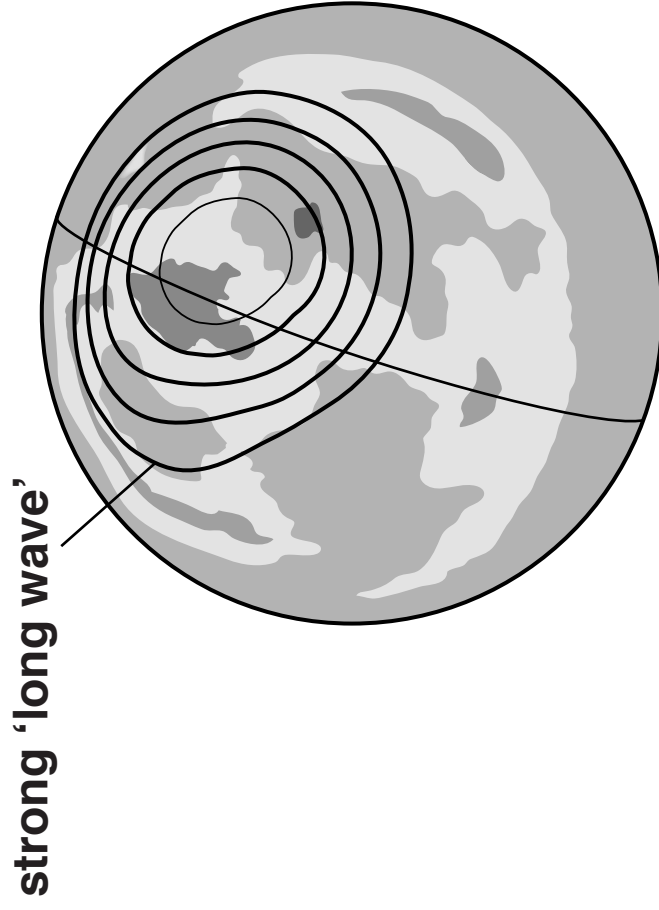
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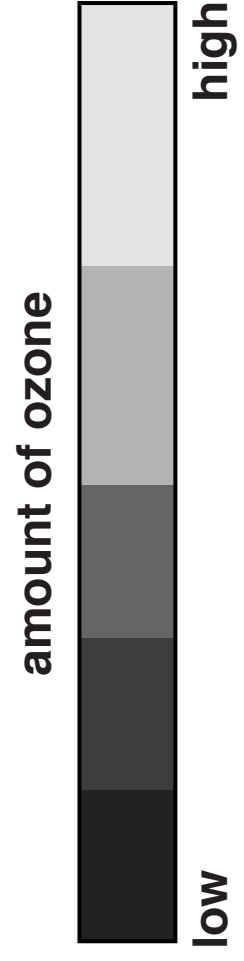
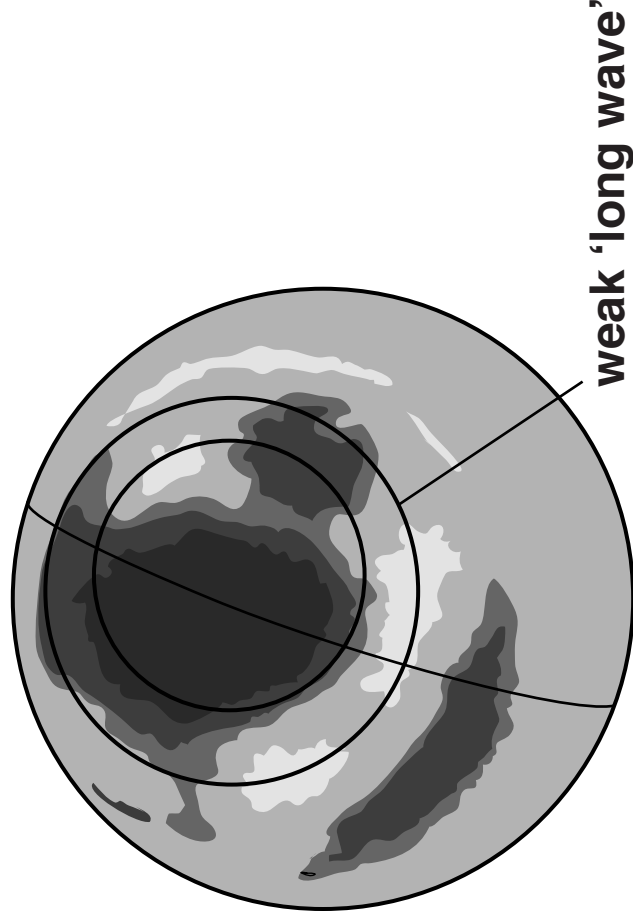
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**[2]**

**Earth's ozone and long wave  
measurements 1984**



**Earth's ozone and long wave  
measurements 1997**



- (b) Pollution from CFCs has changed the size of the hole in the ozone layer over Antarctica.**

**Describe how CFCs have increased the potential danger to human health.**

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[2]

- (c) In 2007 about 200 countries agreed to stop using CFCs completely by 2020.**

- (i) Why is an international agreement important?**

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[1]

- (ii) Some other countries were given until 2030 to completely stop using CFCs.**

**Suggest why some countries have been given different time scales to stop using CFCs.**

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[1]



**13 Microwaves and infrared radiation have different properties.**

**(a) Tick (✓) TWO correct statements about microwaves.**

**Microwaves penetrate about 10 cm into water.**

☐

**Microwaves can be absorbed by body tissue.**

☐

**Microwaves pass through glass but do NOT pass through plastic.**

☐

**The kinetic energy of water increases when it absorbs microwaves.**

☐

**Microwaves do NOT diffract at all.**

☐

**Microwave communication is NOT affected by poor weather conditions.**

☐

**[2]**

**(b) Tick (✓) ONE correct statement about infrared radiation.**

**Infrared radiation penetrates about 1 cm into food.**

☐

**Infrared radiation is refracted by shiny surfaces.**

☐

**Infrared radiation increases the kinetic energy of particles on the surface of food.**

☐

**The energy of infrared radiation DOES NOT depend on the frequency.**

☐

**[1]**

**(c) Infrared radiation can travel along an optical fibre.**

**Look at the table.**

**It shows some properties of materials A, B, C and D.**

<b>Material</b>	<b>Does total internal reflection happen?</b>	<b>Is Multiplexing possible?</b>	<b>Channel speed in bits per second</b>
<b>A</b>	<b>yes</b>	<b>yes</b>	<b><math>100 \times 10^9</math></b>
<b>B</b>	<b>no</b>	<b>yes</b>	<b><math>171 \times 10^9</math></b>
<b>C</b>	<b>yes</b>	<b>yes</b>	<b><math>146 \times 10^9</math></b>
<b>D</b>	<b>no</b>	<b>no</b>	<b><math>273 \times 10^9</math></b>

**The channel speed is the number of bits of information transferred per second.**

**Which material is the best for making optical fibres?**

**Choose from A B C D.**

\_\_\_\_\_

**Explain your answer.**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

**END OF QUESTION PAPER**

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